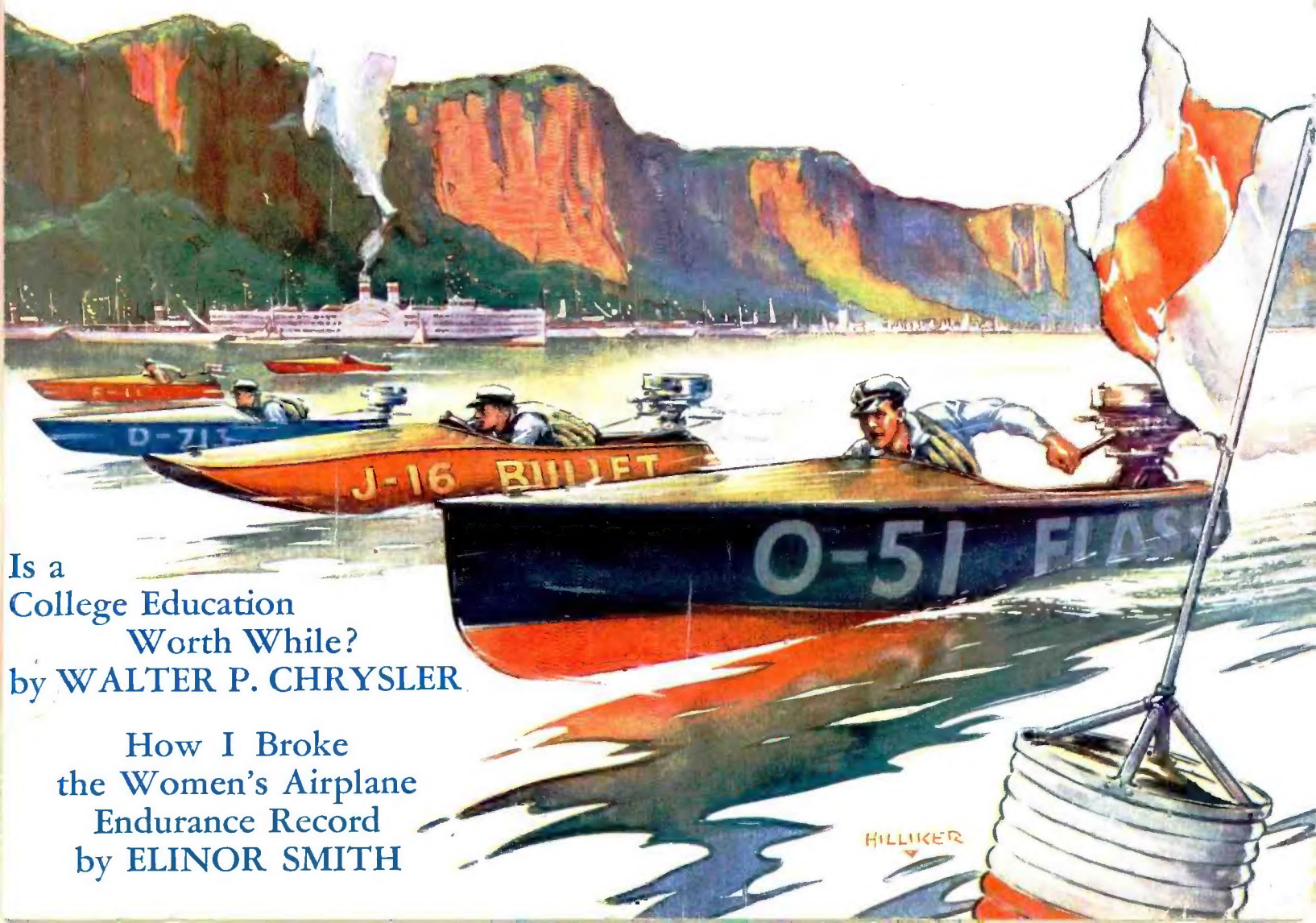
July

25 Cents

Science and Invention

ARTHUR H. LYNCH Editorial Director

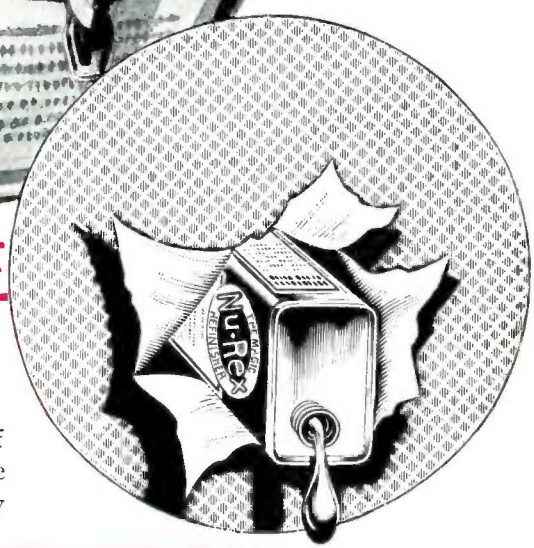


Is a College Education Worth While?
by WALTER P. CHRYSLER

How I Broke the Women's Airplane Endurance Record
by ELINOR SMITH

My Old Car's My New Car NOW!

Only thirty minutes ago I started to refinish my car with this famous magic preparation NU-REX—and NOW!—look at it sparkle. The dull, drab finish is GONE. Yes—and it will be gone forever since I found out about this wonderful NU-REX. It's THE thing for old cars. You should have seen my car before I applied NU-REX. It looked like it was ready for the junk pile. Motor was good—running fine, but how people would stare at me when I drove down the street. "What an ugly looking relic of an automobile," they might say. What could I do? There wasn't a polish on the market that could make this car look like it should. I couldn't afford to spend a lot of money on an expensive paint job. But I got a break. A man showed me NU-REX—applied it—and surprise of all surprises—there was the original lustre and gleam of the original finish. Now—MY OLD CAR'S MY NEW CAR!!!



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—and We'll Back Them With This GUARANTEE of a DRAFTING JOB and RAISE!

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"When I started American School training in the Spring of 1915 I was working 14 hours a night, seven nights a week for $1.83 a night. That Fall I got a job in the Engineering Dept. of a large firm near here. Today I work 5½ days a week and my salary is larger than I ever dreamed of when I began that course in Mechanical Drafting." R. H. SEAVERNS, South Bend, Ind.

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Of course you realize the biggest handicap to mechanical work is that you're limited in earning capacity to the output of your two hands, as long as you live. Even the skilled mechanic earning $50 to $60 a week has reached his limit. He can never earn more and when he gets old he will earn **less.** So I don't blame any man for wanting to get away from his futureless outlook. For wanting to get into something where he can use his **head** as well as his hands—where he will be paid for what he **knows,** instead of only for what he **does**.....You know enough about blueprints to understand that PLANS govern every move in factory and construction job. The Draftsman who makes them is several jumps ahead of the workman who follows them. And so I want you to know that DRAFTING is a logical, natural PROMOTION from mechanical and building work—better-paid, more interesting—just the kind of work you'd enjoy doing.

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The way to a fine Drafting job for **you**—is easier than you think. It takes no "artistic talent" or advanced education. Thousands of men no smarter than you, with no more education or ability have learned it quickly and you can, too. With the co-operation of some of the biggest employers and engineers in the U. S. we have worked out a plan to prepare you for Drafting work in your spare time at home—to actually place you in a fine position **and to raise your pay. Backed by the guarantee shown above to refund the small cost, if we fail.** Mail the coupon and I'll be glad to tell you all about this life-time chance to get into Drafting.

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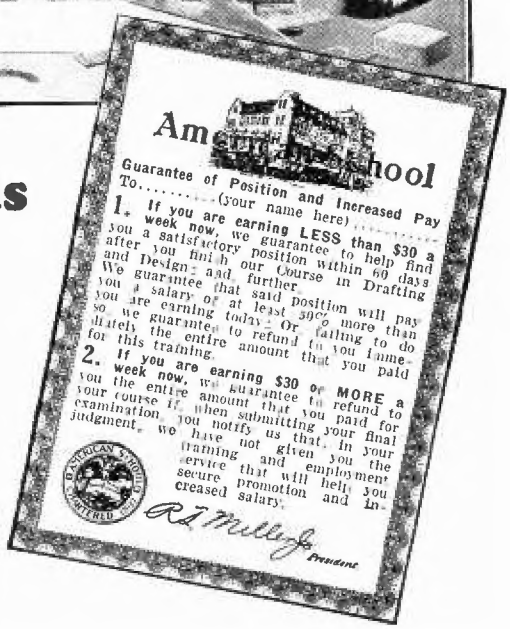
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We guarantee that said position will pay you a salary of at least 30% more than you are earning today. Or failing to do so, we guarantee to refund to you immediately the entire amount that you paid for this training.
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I wish I had the room here to tell you all about DRAFTING—how it has become the most important branch of every kind of manufacturing and construction work—how fascinating the work is—what a fine bunch of fellows Draftsmen are, the big salaries paid—how while Drafting is white-collar office work, it is closely hooked-up with big projects and big men. All that takes a 36-page book to tell and I'll be glad to send it to you free, and in addition I want to send you the first three lessons of our home-training so you can see how you'll like the work and how simple it is to learn. Coupon brings everything—mail it right away.

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Name .....

St. No. .....

City..... State.....

Age..... Occupation.....

.....

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NEXT MONTH

Hobbies of Famous People

Beginning a new series of articles dealing with the pastimes of well-known personages. How Dr. Edward C. Worden, famous industrial chemist, spends his leisure time and "rides" a hobby will be revealed next month.

Do You Want Financial Independence?

Then don't fail to read the article by John J. Raskob who will tell everyone how to acquire a satisfactory income.

A $2,000,000 Fake Battle

The man behind the guns, Capt. E. P. Ketchum, describes how it's done in the movies, where millions of dollars and thousands of men are required to "fake" a war scene.

Make Your Own Boat

William F. Crosby, the marine editor, explains how it can be done. Complete constructional details for a small outboard boat will be presented.

Better Babies

Any one can have strong and healthy children. Modern medicine shows us how. An illustrated article of wide appeal to our readers.

SCIENCE AND INVENTION Monthly, entered as second class matter, at the Post Office at Jamaica, N. Y., under the Act of March 3, 1879. Title registered at the U. S. Patent Office.

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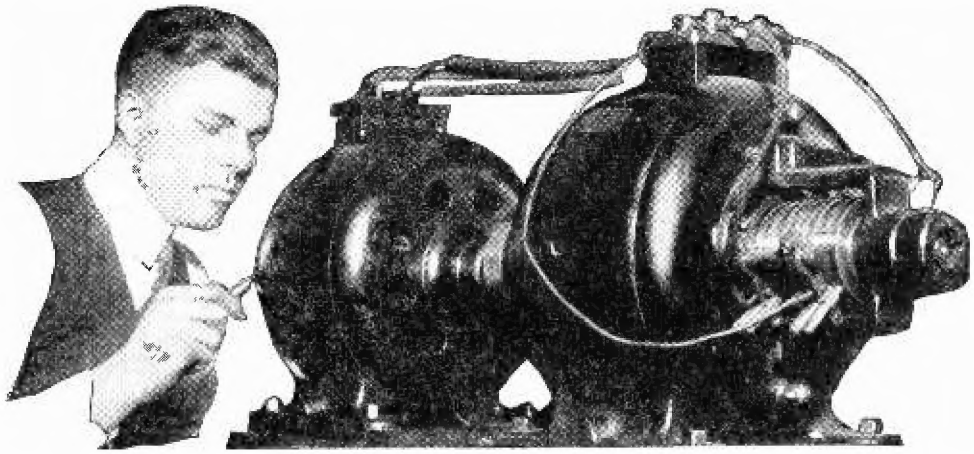

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Don't spend your life waiting for $5.00 raises in a dull, hopeless job. Now . . . and forever . . . say good-bye to 25 and 35 dollars a week. Let me show you how to qualify for jobs leading to salaries of $50, $60 and up, a week, in Electricity—NOT by correspondence, but by an amazing way to teach, that makes you a practical expert in 90 days! Getting into Electricity is far easier than you imagine! Act now, today!

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I will allow your railroad fare to Chicago, and if you should need part-time work I'll assist you to it. Then, in 12 brief weeks, in the great roaring shops of Coyne, I train you as you never dreamed you could be trained . . . on the greatest outlay of electrical apparatus ever assembled . . . costing hundreds of thousands of dollars . . . real dynamos, engines, power plants, autos, switchboards, transmitting stations . . . everything from doorbells to farm power and lighting . . . full-sized . . . in full operation every day!

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No books, no baffling charts . . . all real actual work . . . building real batteries . . . winding real armatures, operating real motors, dynamos and generators, wiring houses, etc., etc. That's a glimpse of how we make you a master practical electrician in 90 days, teaching you far more than the average ordinary electrician ever knows and fitting you to step into jobs leading to big pay immediately after graduation. Here, in this world-famous *Parent school*—and nowhere else in the world—can you get such training!

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Armature Expert	up to $100 a Week
Substation Operator	up to $65 a Week
Auto Electrician	$60 a Week and up
Inventor	Unlimited
Maintenance Engineer	up to $100 a Week
Service Station Owner	$60 a Week and up
Radio Expert	$60 a Week and up

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Don't worry about a job, Coyne training settles the job question for life. Demand for Coyne men often exceeds the supply. **Our employment bureau gives you lifetime service.** Two weeks after graduation, Clyde F. Hart got a position as electrician with the Great Western Railroad at over $100 a week. That's not unusual. We can point to Coyne men making up to $600 a month. $60 a week is only the beginning of your opportunity. You go into radio, battery or automotive electrical business for yourself and make up to $15,000 a year.

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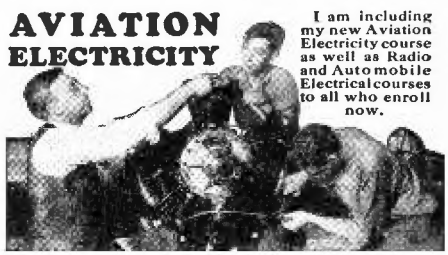
I am including my new Aviation Electricity course as well as Radio and Automobile Electrical courses to all who enroll now.



Students wiring and checking ignition on one of the late type Radial Aircraft Engines in our aviation department.

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Coyne is your one great chance to get into electricity. Every obstacle is removed. This school is 30 years old—Coyne training is tested—proven beyond all doubt—endorsed by many large electrical concerns. You can find out everything absolutely free. Simply mail the coupon and let me send you the big, free Coyne book of 150 photographs . . . facts . . . jobs . . . salaries . . . opportunities. Tells you how many earn expenses while training and how we assist our graduates in the field. This does not obligate you. So act at once. Just mail coupon.

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Dear Mr. Lewis: Without obligation send me your big free catalog and all details of Railroad Fare to Chicago, Free Employment Service, Aviation Electricity and Automotive Electrical Courses and how I can "earn while learning."

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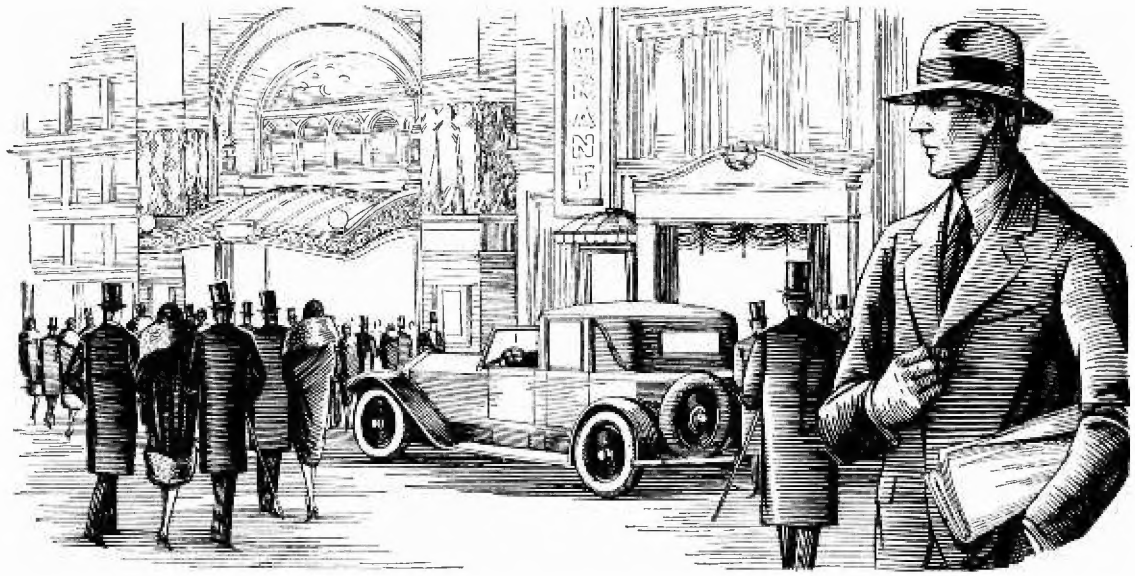
Address.....

City..... *State*.....

Jacob Dunnell is shown above in his boat, "Miss Eastern," which carried him to victory in the Albany-to-New York Outboard Motorboat Race. He was the winner in Class D and covered the 134 miles in 3 hours, 36 minutes and 40 seconds.



Always outside of things—that's where I was just twelve short months ago. I just didn't have the cash, that was all. No theatres, no parties, no good restaurants. No real enjoyment of life. I was just getting by, just existing. What a difference today! I drive my own car, have a good bank account, enjoy all the amusements I please.

I Couldn't Get the Good Things of Life

Then I Quit My Job and "Found" Myself!

HOW does a man go about making more money? If I asked myself that question once, I asked it a hundred times!

I know the answer now—you bet. I know the way good money is made, and I'm making it. Gone forever are the days of cheap shoes, cheap clothes, walking home to save carfare, pinching pennies to make my salary last from one pay-day to the next one. I own one of the finest Radio stores you ever saw, and I get almost all the Radio service and repair work in town. The other Radio dealers send their hard jobs to me, so you can see how I stand in my line.

But—it's just a year ago that I was a poorly paid clerk. I was struggling along on a starvation salary until by accident my eyes were opened and I saw just what was the matter with me. Here's the story of just how it happened.

One of the big moments of my life had come. I had just popped the fatal question, and Louise said, "Yes!"

Louise wanted to go in and tell her father about it right away, so we did. He sort of grunted when we told him the news, and asked Louise to leave us alone. And my heart began to sink as I looked at his face.

"So you and Louise have decided to get married," he said to me when we were alone. "Well, Bill, just listen to me. I've watched you often here at the house with Louise and I think you are a pretty good, upstanding young fellow. I knew your father and mother, and you've always had a good reputation here, too. But just let me ask you just one question—how much do you make?"

"Twenty-eight a week," I told him.

He didn't say a word—just wrote it down on a piece of paper.

"Have you any prospects of a better job or a good raise some time soon?" he asked.

"No, sir; I can't honestly say that I have," I admitted. "I'm looking for something better all the time, though."

"Looking, eh? How do you go about it?"

Well, that question stopped me.

How did I? I was willing to take a better job if I saw the chance all right, but I certainly had laid no plans to make such a job for myself. When he saw my confusion he grunted. "I thought so," he said. Then he held up some figures he'd been scribbling at.

"I've just been figuring out your family budget, Bill, for a salary of twenty-eight a week. I've figured it several ways, so you can take your pick of the one you like best. Here's Budget No. 1: I figure you can afford a very small unfurnished apartment, make your payments on enough plain, inexpensive furniture to fix such an apartment up, pay your electricity, gas and water bills, buy just about one modest outfit of clothes for both of you once each year, and save three dollars a week for sickness, insurance, and emergencies. But you can't eat. And you'll have to go without amusements until you can get a good, substantial raise in salary."

I began to turn red as fire.

"That budget isn't so good after all," he said, glancing at me; "maybe Budget No. 2 will sound better——"

"That's enough, Mr. Sullivan," I said. "Have a heart. I can see things pretty clearly now; things I was kidding myself about before. Let me go home and think this over." And home I went, my mind in a whirl.

At home I turned the problem over and over in my mind. I'd popped the question at Louise on impulse, without thinking it out. Everything Mr. Sullivan had said was gospel truth. I couldn't see anything to do, any way to turn. But I had to have more money.

I began to thumb the pages of a magazine which lay on the table beside me. Suddenly an advertisement seemed almost to leap out at my eyes, an advertisement telling of big opportunities for trained men to succeed in the great new Radio field. With the advertisement was a coupon offering a big free book full of information. I sent the coupon in, and in a few days received a handsome 64-page book, printed in two colors, telling all about the opportunities in the Radio field and how a man can prepare quickly and easily at home to take advantage of these opportunities. I read the book carefully, and when I finished it I made my decision.

What's happened in the twelve months since that day seems almost like a dream to me now. For ten of those twelve months I've had a Radio business of my own! At first, of course, I started it as a little proposition on the side, under the guidance of the National Radio Institute, the institution that gave me my Radio training. It wasn't long before I was getting so much to do in the Radio line that I quit my measly little clerical job and devoted my full time to my Radio business.

Since that time I've gone right on up, always under the watchful guidance of my friends at the National Radio Institute. They would have given me just as much help, too, if I had wanted to follow some other line of Radio besides building my own retail business, such as broadcasting, manufacturing, experimenting, sea operating, or any one of the score of lines they prepare you for. And to think that until that day I sent for their eye-opening book, I'd been wailing, "I never had a chance!"

Now I'm making real money. Louise and I have been married six months, and there wasn't any kidding about budgets by Mr. Sullivan when we stepped off, either. I'll bet that today I make more money than the old boy himself.

Here's a real tip. You may not be as bad off as I was. But, think it over—are you satisfied? Are you making enough money, at work that you like? Would you sign a contract to stay where you are now for the next ten years, making the same money? If not, you'd better be doing something about it instead of drifting.

This new Radio game is a live-wire field of golden rewards. The work, in any of the 20 different lines of Radio, is fascinating, absorbing, well paid. The National Radio Institute—oldest and largest Radio home-study school in the world—will train you inexpensively in your own home to know Radio from A to Z and to increase your earnings in the Radio field.

Take another tip—no matter what your plans are, no matter how much or how little you know about Radio—clip the coupon below and look their free book over. It is filled with interesting facts, figures, and photos, and the information it will give you is worth a few minutes of anybody's time. You will place yourself under no obligation—the book is free and is gladly sent to anyone who wants to know about Radio. Just address J. E. Smith, President, National Radio Institute, Dept. 9TT, Washington, D. C.

J. E. SMITH, President,
National Radio Institute,
Dept. 9TT, Washington, D. C.

Dear Mr. Smith:

Please send me your 64-page freebook, printed in two colors, giving all information about the opportunities in Radio and how I can learn quickly and easily at home to take advantage of them. I understand this request places me under no obligation, and that no salesmen will call on me.

Name.....

Address.....

Town .....State .....

VOLUME XVII
WHOLE NO. 195

Science and Invention

JULY, 1929
NUMBER 3

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PAUL WELKER, Associate Editor.
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"Those Who Refuse to Go Beyond Fact Rarely Get as Far as Fact" - - - - - *HUXLEY*

Bridges or River Tunnels?

ONE of the greatest engineering problems of our time is now being weighed in the balance, the two arguments at issue being whether New York City should have a new Hudson River bridge at Fifty-seventh Street, leading to New Jersey, or under-river tunnels. The leading supporter of the plans for a huge bridge, having a center span of 3,240 feet, with a clearance of 175 to 200 feet, is Gustav Lindenthal, famous designer of bridges. Mr. Lindenthal has been advocating this bridge plan for a great many years, but it was only recently that he has received a strong support from one of the large railroads, the Baltimore and Ohio, which is very desirous of having a continuous rail route into New York City. This newly proposed bridge to span the Hudson River between Fifty-seventh Street, Manhattan, to West New York on the New Jersey shore, would cost $180,000,000, it has been estimated.

One of the most important angles of this new bridge proposal concerns the fact of whether it would not be better to build a new tunnel or tunnels under the Hudson River, instead of erecting this huge bridge. In war time, a bridge is naturally a very prominent target and would be quickly destroyed by aircraft bombers. Another outstanding factor in connection with bridges is that they have to withstand all sorts of weather, and they must be continuously painted, and many of the members replaced from time to time due to corrosion. The annual maintenance expense, while not a prohibitive factor, is, nevertheless, worth considering, even though under-river tunnels would cost considerably more for the initial boring and completion of the tunnel lining.

When we come to under-river tunnels, there are some engineering possibilities which it might be possible to adopt a little later, even though the tunnel is used to convey the well-known electric trains at present. There are several ideas in connection with tunnels, whether underground or underwater, which have been suggested by engineers from time to time, and which would seem to have considerable promise if they can be finally worked out and applied. One of the first innovations concerns the use of moving platforms. The moving platform design in its best form comprises at least three distinct sections, placed side by side, the first platform moving at say three miles an hour; the second, at six miles an hour, and the third at nine miles an hour. When a person boards the moving platform, he can pass from one stage to the next by simply stepping across from one of the moving surfaces to the next. The triple moving platform arrangement would be necessary only at the terminals of an under-river tube; but for city subways it can be advantageously employed for a considerable length of run, where a number of local stations are located along the platform. With regard to tunnels and subways, we will probably see in the future a different method of carrying passengers through such bores; that is, by means of carriers operating on a similar principle to those used in the present-day mail-tube system. By suitably utilizing air under pressure and also the remarkable properties of a vacuum, passenger-carrying cars could be hurtled through a tunnel at high speed, thus giving a far greater traffic-carrying capacity. One scheme, proposed some years ago, for levitating and then propelling subway cars by means of magnets placed along the track is impractical, owing to the tremendous cost of carrying out such an idea.

When we stop to realize what a vast amount of money $180,000,000 really is, one can hardly refrain from thinking of how many airplanes of the tri-motor passenger-carrying type this would buy.

As one stands at the edge of the Hudson River, and seriously ponders over the problem of transporting passengers and freight across the water, a distance of approximately three-quarters of a mile, the idea naturally asserts itself as to whether or not it would be economically and practically feasible to carry out this movement of people and commodities by air. At present, the airplane is not the cheapest form of carrier, but it shows a very fair comparison with the automobile. One idea would be to employ a modified form of aerial traffic carrier, which involves the use of a car similar to an airplane cabin, this car being suspended from a cable. The car would be propelled by either the usual air propeller, driven by a suitable engine mounted in the car; or else, the car could have an air screw driven by an electric motor, which would derive its electric power from an auxiliary cable with which a second set of wheels would make contact.

H. Winfield Secor
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Is a College Education

By H. T. Parson,
President of F. W. Woolworth Co.

IN reference to the question "Is a College Education Worth While?"—it depends entirely on what a man expects to qualify for in the business world.

If he is going in for the engineering profession or technical business, a college course is essential; but if he is going in for general merchandising business, especially retail trade in which the F. W. Woolworth Co. is interested, we prefer men who have finished their full public school education and then graduated from high school.

After a man has had that foundation education, we give him a three-year post-graduate course in practical experience, training him from the basement to the office, in the ways and means of store management and operation. All of our managers are graduates from this School of Apprenticeship, and all of the men in the higher positions of our business have passed through this lower course of education and experience to the positions they now hold.

College men, as a rule, are prone to feel that they know all there is to be known and that a practical business course is not necessary for their future success; consequently, they do not interest us when they apply for a position, as no man, no matter what his experience has been, can be of value to the Woolworth Co. without going through this three-year apprenticeship period.

If you will talk to any experienced Woolworth manager, buyer or executive, you will find that the three years' practical training they had to start them in the business was worth all the sacrifices that they put into it, and was better for them than any college course, for practical training and success in the business which they had undertaken.

Is a College Education Worth While?

SOME time or other in the lives of all of us, this question crops up. We must weigh it carefully and give it due consideration.

Perhaps we would like to go to college.

Perhaps we have sons or daughters whom we would like to send to college.

Perhaps they would care to go, but we question the value of that college education.

The most logical step to take would be to ask someone who knows.

This publication has tried to make it easier for you, and before the next college term opens, and prior to matriculation, we will present to you the opinions of the leaders in industry, arts and sciences on this subject. The determination of the value of the college education we will leave to you.

If perchance you care to say something on the subject, remember that there is a "What Our Readers Think" Department for just such comments.

Photo by Blank & Stoller

Mr. Parson began in 1892, as accountant with the F. W. Woolworth Co. five and ten cent stores. He advanced through various positions to Secretary, Treasurer, General Manager, and since 1919 he has been President of that Company, President of the Broadway Park Place Co., and director of the Irving National Bank. He was born in Toronto, Canada, in 1872 and was educated at high school in Brooklyn.

Opinion of Walter P. Chrysler
President of Chrysler Motors

THIS is an age of young people. Opportunities in industry were never greater. In my opinion, the trained man or woman has a decided advantage, and with hundreds of colleges and universities throughout the country, there is little excuse for a boy or girl not preparing himself or herself for the battle of life.

However, if those seeking their way in the world are without scholastic or technical training, they still have the opportunity of obtaining the equivalent by home instruction. It all depends on how hard they are willing to work to achieve success. The thing I learned early in life was, the one reasonably sure way to get ahead was to do just a little bit more than was expected of you.

This is truly a wonderful age. Never were the rewards as large and I do not mean in terms of money alone. Many very wealthy men, as well as many great students, have registered zero in the march of progress. With radio and airplanes spanning the world, bringing all nations closer together, and to a closer appreciation and understanding, and with millions of motor cars traversing our streets and highways, the world today can truly be called a prosperous one.

I chose transportation as a vocation and this is not hard to understand, when I tell you that my grandfather drove a covered wagon across the plains and my father was a locomotive engineer on one of the old wood-burning engines of the Union Pacific Railroad. I served my apprenticeship on this same road and later became interested in the idea of individual transportation and left railroading at a sacrifice of half my salary to enter the automobile industry.

Throughout this period I studied. I acquired the theoretical as well as the practical from text books, from magazines and even from pictures in the mail order catalogues. I took a course in draftsmanship by mail. These all helped and at the same time I put in 12 hours or more every day in the shops and offices connected with my job.

I believe the poor boy has a great advantage over the boy of wealthy heritage in establishing his future life. The youngster in moderate circumstances can "get there" only in doing constructive things. The wealthy boy often is inclined to spend money and in some cases does so in a purely destructive manner.

Most certainly I believe a college education is worth while; however, it must be borne in mind that a degree in arts or science is nothing more or less than additional equipment with which to tackle the problems of life.

Finding one's greatest field of aptitude is the initial step in the ladder of success. Next in importance comes sincere application to the task in hand, and finally success may be reasonably expected in the exact proportion to the effort one is willing to expend.

My advice to the new generation is to be courageous, hopeful and enterprising, and to march on and achieve. The world rewards effort, and when it compensates us for achievement of genuine merit it invariably proves to be a generous world.

Worth While?

Walter P. Chrysler was born in Wamego, Kansas, April 2, 1875. He is a graduate of high school and has much illustrious work to his credit. Serving first in the mechanics department of railroads from machinist's apprentice to superintendent of motive power and machinery at the age of 33, he was appointed Assistant Manager in the Pittsburgh works of the American Locomotive Co. in 1910, and became Manager in 1911. He was Works Manager of the Buick Motor Co. from 1912 to 1916, and President and General Manager from 1916 to 1919. Thence, Vice-President in charge of operations of General Motors Corp. Next, Executive Vice-President of Willys-Overland Co. Thereafter he served as the chairman for the reorganization committee of the Maxwell Motor Corp., and at present is President and Chairman of the Board of the Chrysler Corp., as well as director of several other companies.

College Education Positively Worth While

By Prof. F. E. Austin

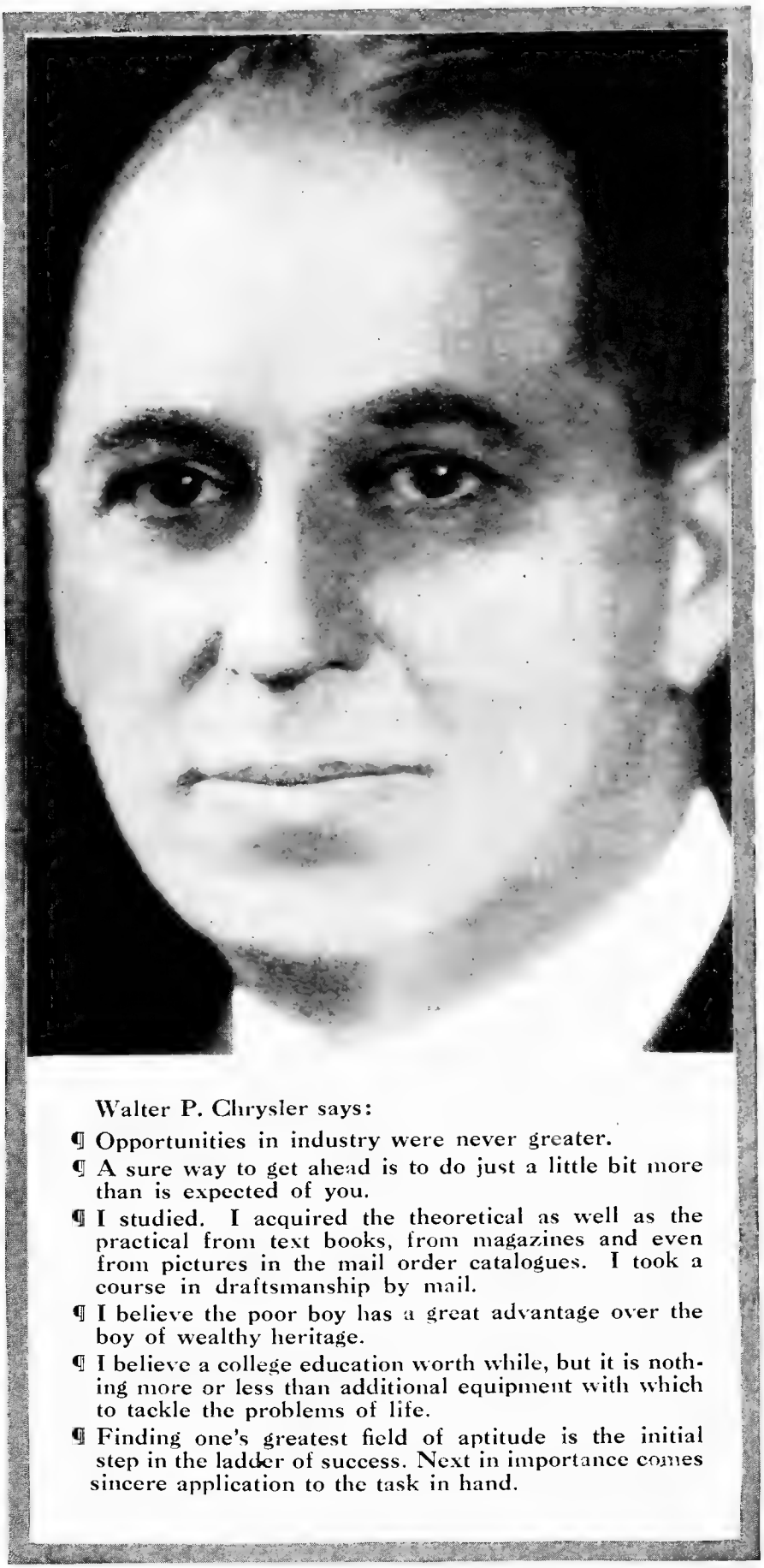
Professor Austin organized the electrical engineering course at the Thayer School of Engineering, connected with Dartmouth College, and later a similar course for Norwich University at Northfield, Vermont, and was subsequently made professor in charge at both institutions. Although at present not connected with any college faculty, he is a firm believer in the value of a college education. Professor Austin's name is not unknown to the readers of this publication. On this subject he writes as follows:

WHEN the toastmaster announces the subject assigned to the after-dinner speaker, the assembled guests expect to listen to information pertaining to other subjects than the one announced.

This expectancy is based somewhat on tradition. This evasive tendency of the after-dinner speaker is prevalent among writers who are prone to talk more about matters in general than about their headlines.

The general public has become so accustomed to the diversions of speakers and writers that it might prove disconcerting to disappoint them now. As a matter of fact, one should not expect one hundred per cent efficiency in either speakers or writers; any more than he should in an electric motor, a steam engine, or a jazz band.

We never realize one hundred per cent efficiency in the realms of nature. We never have and never will enjoy one hundred per cent efficiency in education. Maybe you suspect that what I am endeavoring to do is talk about something other than the subject the editor has assigned me. I will sustain your suspicions by saying I would (*Continued on page 274*)



Walter P. Chrysler says:

- ¶ Opportunities in industry were never greater.
- ¶ A sure way to get ahead is to do just a little bit more than is expected of you.
- ¶ I studied. I acquired the theoretical as well as the practical from text books, from magazines and even from pictures in the mail order catalogues. I took a course in draftsmanship by mail.
- ¶ I believe the poor boy has a great advantage over the boy of wealthy heritage.
- ¶ I believe a college education worth while, but it is nothing more or less than additional equipment with which to tackle the problems of life.
- ¶ Finding one's greatest field of aptitude is the initial step in the ladder of success. Next in importance comes sincere application to the task in hand.

New Trans-Flight.

The Second Airplane Flight From Europe to America Is Scheduled to Take Place During the Month of June

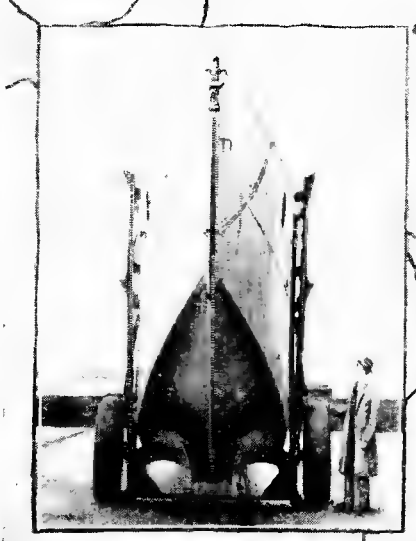
Dr. Adolph K. Rohrbach, designer and builder of sea and land planes, who is now planning a trans-Atlantic flight with a 10-ton twin-motored flying boat.

THE second flight from Europe to America by a German machine is scheduled to take place in June, when the Rohrbach-Rostra, one of the smaller types of the transoceanic flying boats of the Rohrbach company, built for freight traffic, is expected to arrive in New York from Lisbon, Portugal. The start will be from Travemunde, on the Baltic sea, where the preliminary trials took place; from there it calls at Lisbon for the cargo which is to be taken on board. This will be the first cargo flight of a heavier than air craft between Europe and America in either direction.

The German "Luft Hansa" has placed an order for three Rohrbach "Roma" flying boats, showing a special confidence in the Rohrbach works, with which they will establish an air line from Lisbon to South America. These large machines are equipped with three BMW VI UZ engines of 1650-2160 horse-power, they accommodate twelve passengers and a crew of five and weigh loaded about twenty tons. They have the distinctive cantilever, tapered wings and can fly some 1800 to 2400 miles with a pay load of 2420 pounds.

Features of the Plane

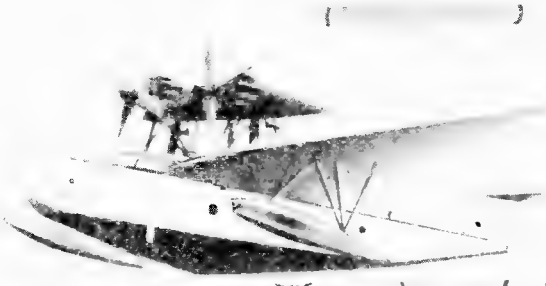
THE Rohrbach "Rostra" is a smaller type with the same general all metal construction characterizing the "Roma" craft, and is driven by two air-cooled engines, "Jupiter VI Gnome et Rhone." The hull is divided into water-tight compartments by bulkheads, each of which can be independently opened or closed. In the bows of the hull is the navigator's cockpit, behind him



The photograph at the left shows a front view of the hull of the "Rohrbach Rostra." This portion of the ship is divided into bulkheads.

Atlantic

By Augustus Post



come the two pilots, side by side, with the engineer in a small compartment of his own. When the ship is arranged for passengers, they are accommodated in pairs on either side of a central gangway, but this space will probably be taken up on this flight by supplies, extra tanks and cargo. A wireless mast can be set up for communication while on the surface of the sea. Direct cu-finding apparatus and a wireless outfit, exceedingly compact and said to weigh not more than twelve pounds, with which communication can be maintained between Berlin and New York harbor, will be part of the equipment.

In the illustration showing the side view, 1 is the collision room; 2, cockpit; 3, freight room; 4, passengers' room (if passengers are carried); 5, collapsible radio mast; 6, auxiliary radio set; 7, radio set; 8, generator.

As the engines are carried well above its single wing, which is also very wide near the hull, protecting the motors from flying spray, the "Rostra" can operate in rough seas in comparative safety. A full sea equipment including anchors, hawsers and, when required, masts and sails to navigate on the surface in case of motor failure or the lack of fuel, make this craft ideal for long ocean flights.

Taking advantage of the preparations to establish the transoceanic air line to South America by the "Luft Hansa" with the Rohrbach "Roma" type of flying-ships, the "Rostra" will follow the southern route as far as Fernando Noronha, and then turn north and follow up the coast via the Barbadoes and Porto Rico to New York. An alternative course is under consideration from the Cape Verde islands straight across to the Barbadoes.

An Interview with Dr. Rohrbach

IN a recent interview with Dr. Rohrbach, he said

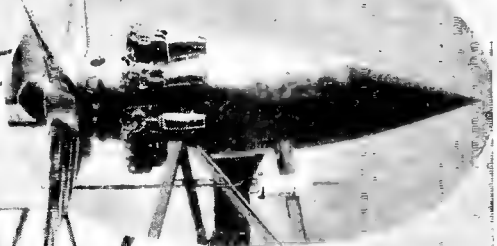
"The flight across the Atlantic has not been a sudden inspiration on my part. For the past eight or ten years I have carefully studied the problem of ocean flying (*Continued on page* 282)

A map of the route to be taken in the proposed flight is shown here.

TRAVEMUNDE

Miss Mildred Johnson who will be one of the passengers.

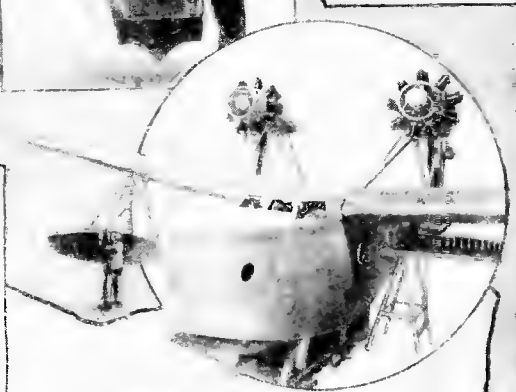
LISBON



Above is one of the motors and at the left is a photograph of one of the pontoons. Below is a three-quarter front view. Compare size of ship with man.

Contemplated Route

CAPE VERDE IS.

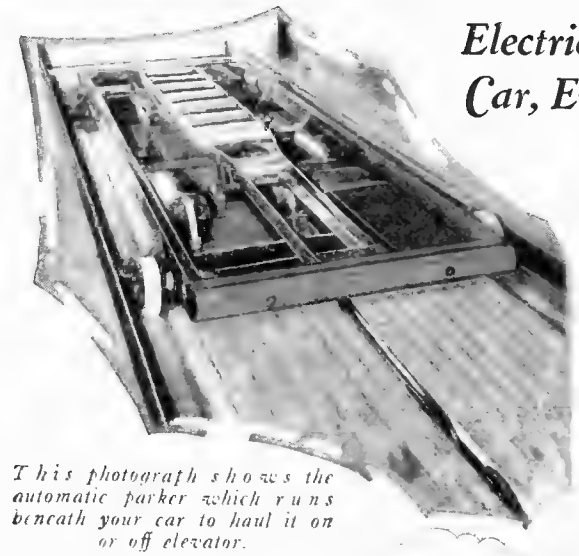


The illustration at the left shows a side view. See text.

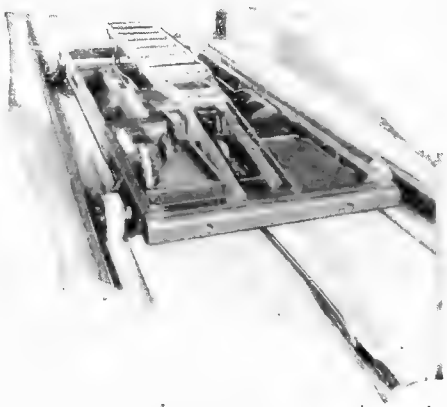
FERNANDO NORONHA (BRAZIL)

Electric Parker Runs Beneath Car, Engages It, and Hauls It Away

Automatic Garage



This photograph shows the automatic parker which runs beneath your car to haul it on or off elevator.



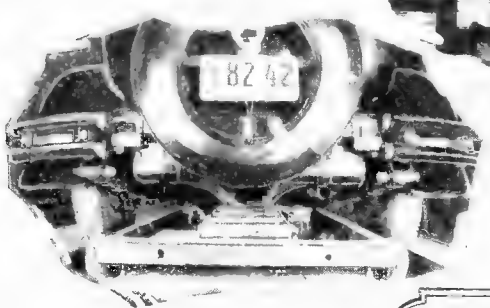
A motor operates the rack, lifting it up and engaging it with the differential housing.

IN New York City there is a garage known as the Kent Automatic Garage, wherein you leave your car, head on, with motor stopped and doors locked, in front of an elevator door, and receive a claim check. When you call for it, you present your claim check at the cashier's office, and in less than two minutes from the time you deliver your claim check your car is waiting for you, even though it may have been parked all day on the twentieth floor of the building. Here the cars are handled entirely by electricity.

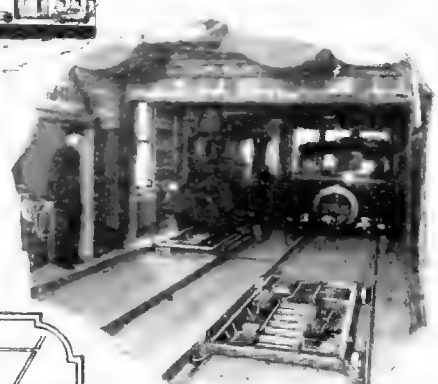
An electric parker, a low, rubber-tired towing unit runs beneath your car, engages the rear axle, pulls the car on the elevator and then out again on the floor, where space for it has been allotted. The instant that you present your claim check at the cashier's desk, a telautograph notifies the elevator operator where your car is. By the time this has finished writing, he has arrived at the floor. The doors of the elevator automatically open, the parker runs out under the car, tows it on the elevator, which in turn carries it down to the ground floor, and delivers it ready to drive away. Two cars can be handled by each elevator at one time.

(*Continued on page 263*)

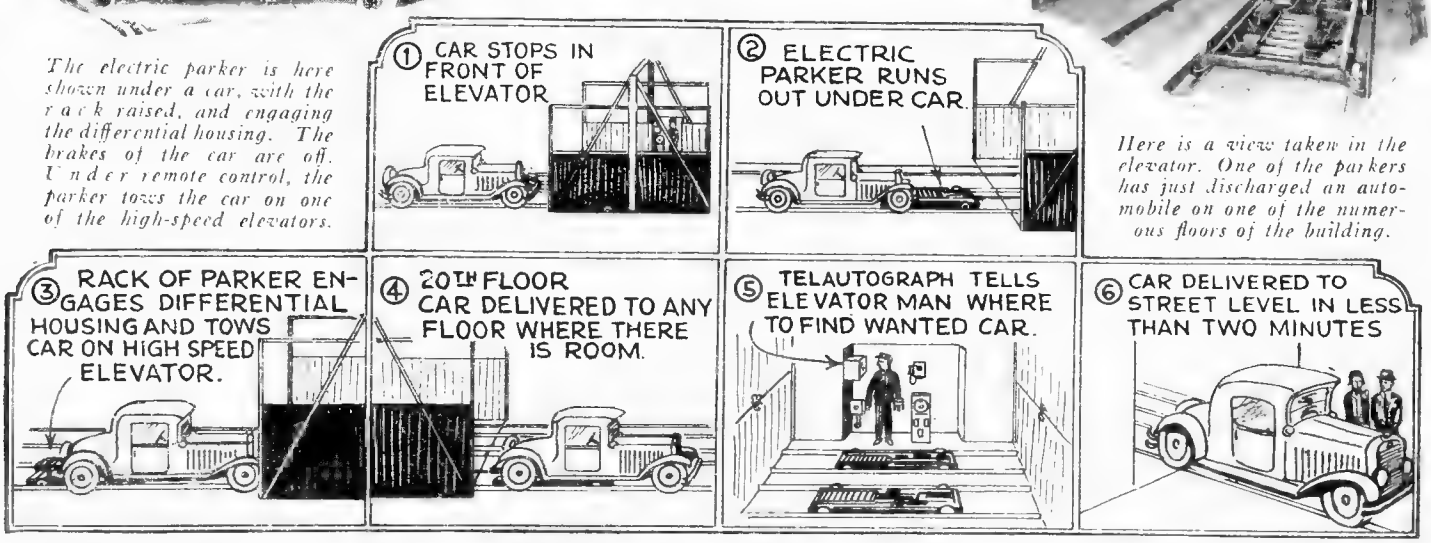
Above: The layout of the thousand-car garage. Below: How the system operates. The motorist stops his car at the elevator. The elevator man sends out the parker, which tows the car on the elevator and pulls it out on the floor allotted to it. See story for further details.



The electric parker is here shown under a car, with the rack raised, and engaging the differential housing. The brakes of the car are off. Under remote control, the parker tows the car on one of the high-speed elevators.



Here is a view taken in the elevator. One of the parkers has just discharged an automobile on one of the numerous floors of the building.


① CAR STOPS IN FRONT OF ELEVATOR
② ELECTRIC PARKER RUNS OUT UNDER CAR.
③ RACK OF PARKER ENGAGES DIFFERENTIAL HOUSING AND TOWS CAR ON HIGH SPEED ELEVATOR.
④ 20TH FLOOR CAR DELIVERED TO ANY FLOOR WHERE THERE IS ROOM.
⑤ TELAUTOGRAPH TELLS ELEVATOR MAN WHERE TO FIND WANTED CAR.
⑥ CAR DELIVERED TO STREET LEVEL IN LESS THAN TWO MINUTES

How I Broke *the* Women's Airplane Endurance Record

By Elinor Smith

The personal story of the seventeen-year-old flyer, written exclusively for this magazine

A photograph of the plane piloted by Miss Smith, which was taken during the endurance flight, is shown above.

Above, the author is shown in the cockpit of her plane, and at the left is a view taken just after she had landed the six-passenger 220-horsepower Bellanca.

YES, I was thrilled when it was all over—though I was too deaf for a while to know what it was all about. I felt fine, though. I had been a little air-sick, but that didn't last long. It was a wonderful day. Warm and clear—and I just enjoyed staying up there in the air. I took up plenty of food, but I didn't eat anything during those twenty-six hours. I didn't feel hungry and I didn't feel sleepy. I just wish I had had more fuel, because it would have been easy to stay up another ten hours just as well as not. After you've stayed up twenty-six hours without getting tired, you can stay another ten or twelve without any trouble.

And the best part of it all was that I could *sleep* when I came down. After my first endurance flight last February, though I had stayed up only thirteen hours, I came down dead tired and *sleepy*, and yet I couldn't sleep for three nights. It was awful to be reeling around dead tired after that flight and yet not be able to sleep. But this time I guess I was in better condition. I have a good doctor, and he had been watching and taking care of me and got me into shape so that this second time I didn't have any bad after-effects at all, except for a little deafness which only lasted about three hours after I came down. I didn't lose any weight either, though after that thirteen-hour record I had lost five pounds.

I can't say too much for that six-passenger 220-horsepower Bellanca I flew. It was super. It was pretty heavy, of course. They tell me that I'm the first woman to fly a heavy Wright motor in a Bellanca. In cross-country work, of course, I always prefer the Wright or Wasp in preference to a light motor.

I went up with 210 gallons of fuel, and when I came down I had only three-quarters of a gallon left. After my wing tanks gave out, I ran as long as I dared on my emergency five gallons. My stabilizer went hay-wire while I was up there, and from 6 A. M. till 2:30 P. M. I had to wrap my arms around the control stick and hold it. It was pretty tough for a while, but after that the stabilizer straightened up, and I just held the stick in one hand and a book in the other and read. I took "Tom Sawyer" along with me in case I felt like reading. I kept within gliding distance of the ground along toward the last, and when my fuel ran out I landed. That was all there was to it. It was easy. Oh! This record won't last long—I don't think. Anyway, I did what I wanted to do—and that is, bring it back to the East coast—for a time, anyway.

There's nothing to be afraid of about flying. If you're careful, there really isn't anything that can happen to you. If you look over your motor and check up your rigging before going up, there's absolutely no cause for failure in the air.

I counted up the other day—and I've flown about forty different ships so far, so that I know practically every make. Of course, I've been riding in planes ever since I was eight years old. My dad's an actor by profession, but he has always flown, and he used to take me up with him when I was a little girl. I've always played around planes—so that when the time came that I took instructions there was practically nothing I hadn't seen or heard of before. Dad didn't want me to take to solo flying before I was eighteen. I don't blame him, really—because, naturally, he thought eighteen was young enough for me to know what I wanted to do. But I (*Continued on page 266*)

SPIRIT SÉANCE *Produces*

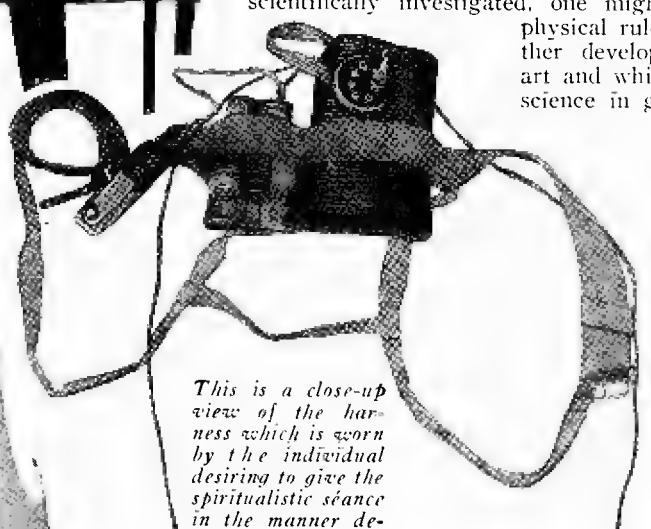
Dunninger, Chairman of SCIENCE AND Committee, by the Aid of Radio Produces Those Claim Are Possible, Yet Which Have Never Been

The above photograph shows a skull placed on the table, but separated from the table top by a glass plate. A square glass cover is then placed over the skull. The jaws of the skull rap out an answer to any question. Mr. Dunninger is seen putting the glass cover in place.

This illustration shows Mr. Dunninger standing in back of the mysterious light supported from two upright standards set in the table. The light will turn on or go out at command.

THE readers of this publication know that for years we have posted an award of $21,000.00 in prizes for genuine spirit manifestations. During the past six years (since this award was originally published) many mediums have chosen to sit before the Investigating Committee of this publication, of which Mr. Joseph Dunninger is chairman. These mediums have so far been unable to produce one single manifestation that could by even the greatest stretch of the imagination be classed as being of spiritual origin. Reports from Europe and other foreign countries spoke of horns blowing, hands rapping, drums rolling, and objects being moved beneath glass covers. In America, those things are not open to scientific investigation. If they are done at all, it is always under cover of darkness, where any subtle means can be employed to manipulate the devices and when no investigators are present. The researches into spiritualism so ably carried out by the late Harry Houdini have been continued with even greater vigor by our own Mr. Dunninger.

This magazine is as anxious to get genuine spiritual phenomena as they are to expose the frauds. The reason is obvious. If spiritual phenomena exist, and if they can be scientifically investigated, one might discover some new physical rules which could be further developed in advancing this art and which would be a boon to science in general.



This is a close-up view of the harness which is worn by the individual desiring to give the spiritualistic séance in the manner described.

Mr. Dunninger wearing the radio harness with which it is possible to control the apparatus for spiritualistic séances. The transmitter is enclosed in a well-padded case so that it is noiseless. Four flashlight cells operate the device. The aerial and counterpoise are concealed in the trouser legs, as indicated by the dotted lines. The key is held in the right hand.

Newspaper Reporters Witness Séance

IN response to an invitation from the editors of this magazine, newspaper reporters from every cosmopolitan paper attended a daylight séance at our editorial offices. In the letter they were told that manifestations would positively take place, and even they themselves would be permitted to produce the self-same effects. On arrival, they found a small black table in the room, which could be lifted from the floor to indicate that it was not connected by wires with any other part of the room. They were soon to get the surprise of their lives. Taking a sheet of glass and placing this on the table, Mr. Dunninger deposited on top a papier-mâché skull that had been previously examined. He then covered the skull with a square glass container, so that it could not be tampered with or manipulated by strings, wires or any of the other appurtenances ordinarily used by the magician and even more frequently used by the average medium. At a given signal from any member of the audience, the skull clicked its jaws. The glass cover, glass plate and skull were then passed for examination, and a plaster-cast in the shape of a human hand was put on the table.

At command, this hand rapped out a message by clicking the table-top. Mr. Dunninger now put a child's horn on the table. A blast from this indicated spirit control, or at least some form of control. Then a child's drum was substituted, and this beat

Via RADIO *Results*

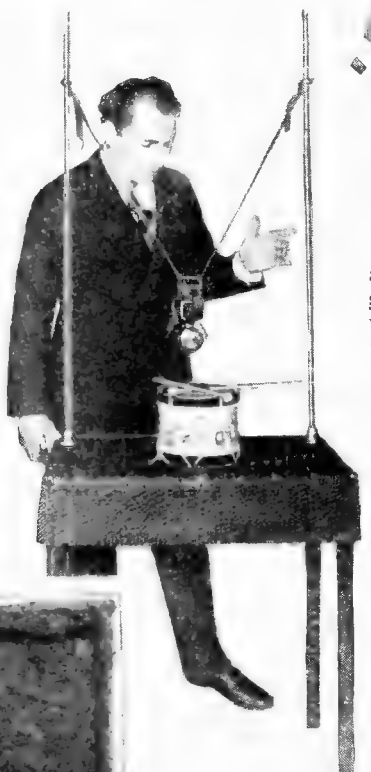
INVENTION Psychical Investigation Very Phenomena Which Many Mediums Demonstrated at Any of Our Tests

By JOSEPH H. KRAUS

Mr. Dunninger and the rapping hand which taps out any signal desired and which is controlled by radio at a distance of from 12 to 20 feet or at a mile.

out a rapid tattoo again at command, and finally an electric light was made to light or go out and a bell was made to ring as often as any member requested and at any prearranged signal.

Now, were any of these effects accomplished in a spiritualistic séance and attributed to spirits, they would have been considered nothing short of phenomenal. Here were actual manifestations, those that one frequently reads about but rarely ever sees. In so far as the Investigation Committee of SCIENCE AND INVENTION Magazine is concerned, in its six years of investigation, and in spite of the fact that an award of $21,000.00 is posted in each and every issue of this publication, we have never received any greater phenomenon than a message or two, the authenticity of which was quickly doubted and the accuracy of which messages fell far short of even a remotest possibility.

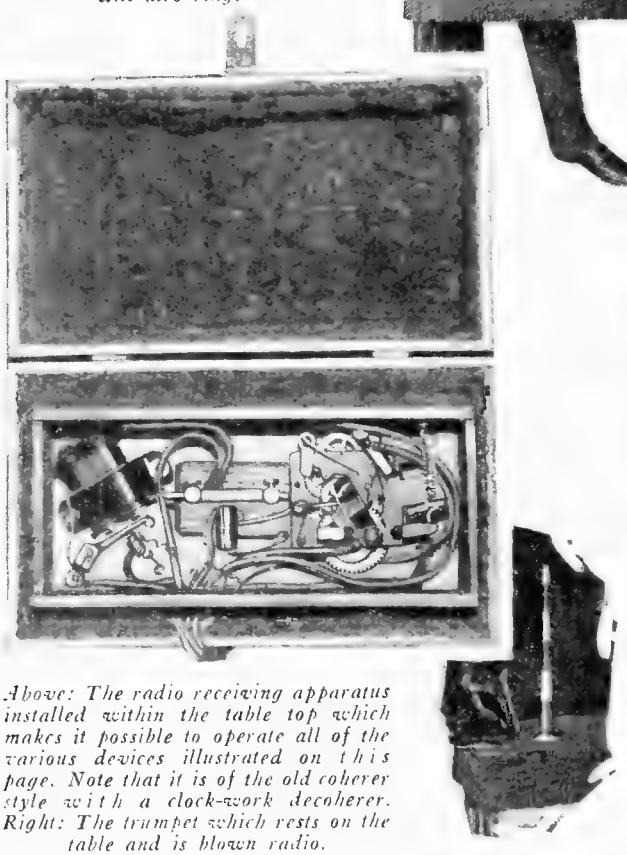


Mr. Dunninger and the drum which rolls a call whenever it is commanded to do so. The bell will also ring.

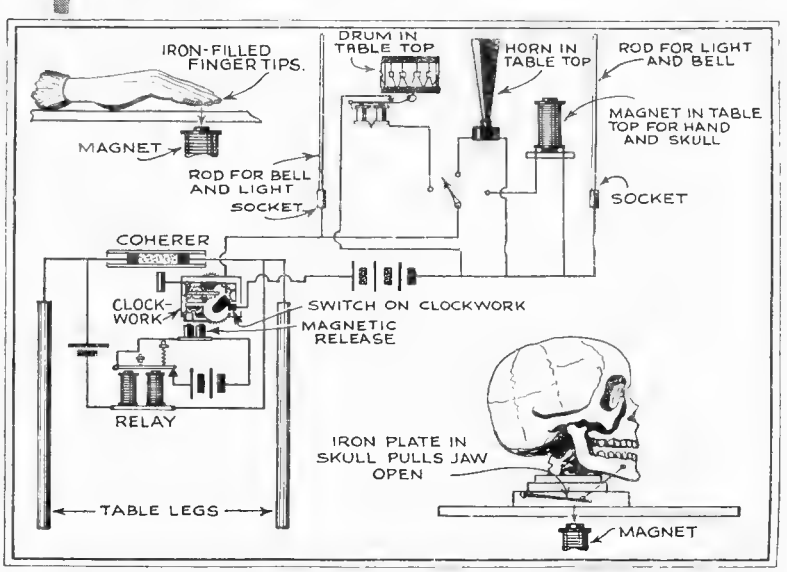
The Transmitter

AT this stage of the game, Mr. Dunninger removed his coat and showed the audience the harness that he had been wearing all afternoon, and yet not a single member was aware of the fact that all of the apparatus was being controlled by any person in the room.

As can be observed from the photographs, the device consists of a small black wallet and four flashlight batteries. There is an added control, as well as a key for closing the circuit. The wallet contains a spark coil, spark gap and condenser. The spark coil is operated by the four flashlight batteries held together in a clip. Both are supported at the waist by a harness. The aerial and counterpoise consist of two well insulated (*Continued on page 272*)



Above: The radio receiving apparatus installed within the table top which makes it possible to operate all of the various devices illustrated on this page. Note that it is of the old coherer style with a clock-work decoherer. Right: The trumpet which rests on the table and is blown radio.



This is the complete circuit diagram of the outfit found in the table-top whereby it is possible to duplicate the phenomena here listed.

UNDER the ICE

Captain Sir Hubert Wilkins intends to use a sub-

Captain Sir Hubert Wilkins, the well-known polar explorer, who will use a submarine in his next adventure.

SUBMARINE exploration of the polar seas is the latest adventure upon which Captain Sir Hubert Wilkins, the well known polar explorer, intends to embark. The submarine "Defender," owned by Simon Lake, the eminent designer and builder of sub-sea craft, is the only privately owned submarine in the world. It was built in 1906 at Mr. Lake's plant at Bridgeport, Conn. Captain Wilkins recently visited Bridgeport and looked over the submarine "Defender," and expressed his satisfaction with it for his contemplated trip to the polar seas. In a recent interview, Mr. Lake explained to the writer that with the proper redesign or rather reinforcement of the top of the submarine, this type of vessel is very seaworthy, especially in the polar waters where ice of various kinds is encountered. Mr. Lake showed the writer a photograph taken some twenty years ago in Narragansett Bay, which showed a submarine just after it had broken upward through ice approximately eight inches thick. Where the ice is of the variety known as slush ice, a vessel built with a strong steel tapered ridge, similar to that shown in the accompanying illustration, can pierce its way upward through a far greater thickness than eight inches, yet this is not the limit.

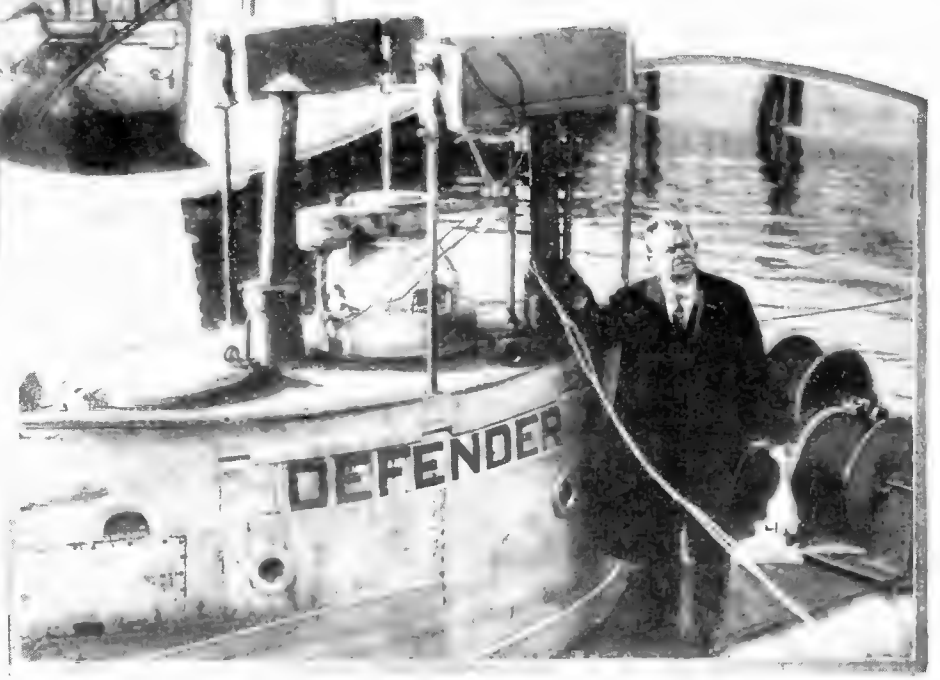
One of the objects of carrying out submarine explorations and tests in the polar seas is that this will help to demonstrate the possibility of utilizing submarines for opening up trade routes in northern Canada and northern Siberia. Mr. Lake pointed out that quite a large number of navigable rivers flowed northward into the Arctic in both regions, and grain, as well as minerals and oil, abounding in these regions could be barged northward to the river mouths, and from these points it could be brought, by specially built submarines, to more southerly points.

Changes Required in Polar Submarine

THE submarine "Defender" has a beam of 11 feet compared to that of present-day submarines which is 20 feet, and the length of the "Defender" is 98 feet compared with 300 feet, the average length of modern submarines. The "Defender" has quarters for eight men, but four more bunks can be installed by removing the torpedo tubes; thus raising the passenger-carrying capacity to 12. The crew will comprise a navigator, two quartermasters, two engineers and two electricians, and several scientists will go with them.

The hull of the "Defender" is made of 3/8-inch thick steel plate, and the accompanying drawings show how the top of the hull will be reinforced with a steel prow, so as to cut through the ice either longitudinally or vertically. This steel prow reinforcement will comprise a series of steel beams, with proper bracing members, and the beam structure will then be covered with steel plate about 3/8-inch thick. This deck reinforcement will run from bow to stern and cover the

At the left is a photograph of the interior of the under-sea boat with a diver ready to enter the water.



Mr. Simon Lake is shown below with his submarine, "Defender," which was built at Bridgeport, Conn., in the year 1906. This boat is the only privately owned submarine in the world. The design will have to be changed to a certain extent before it can be used on the polar expedition.

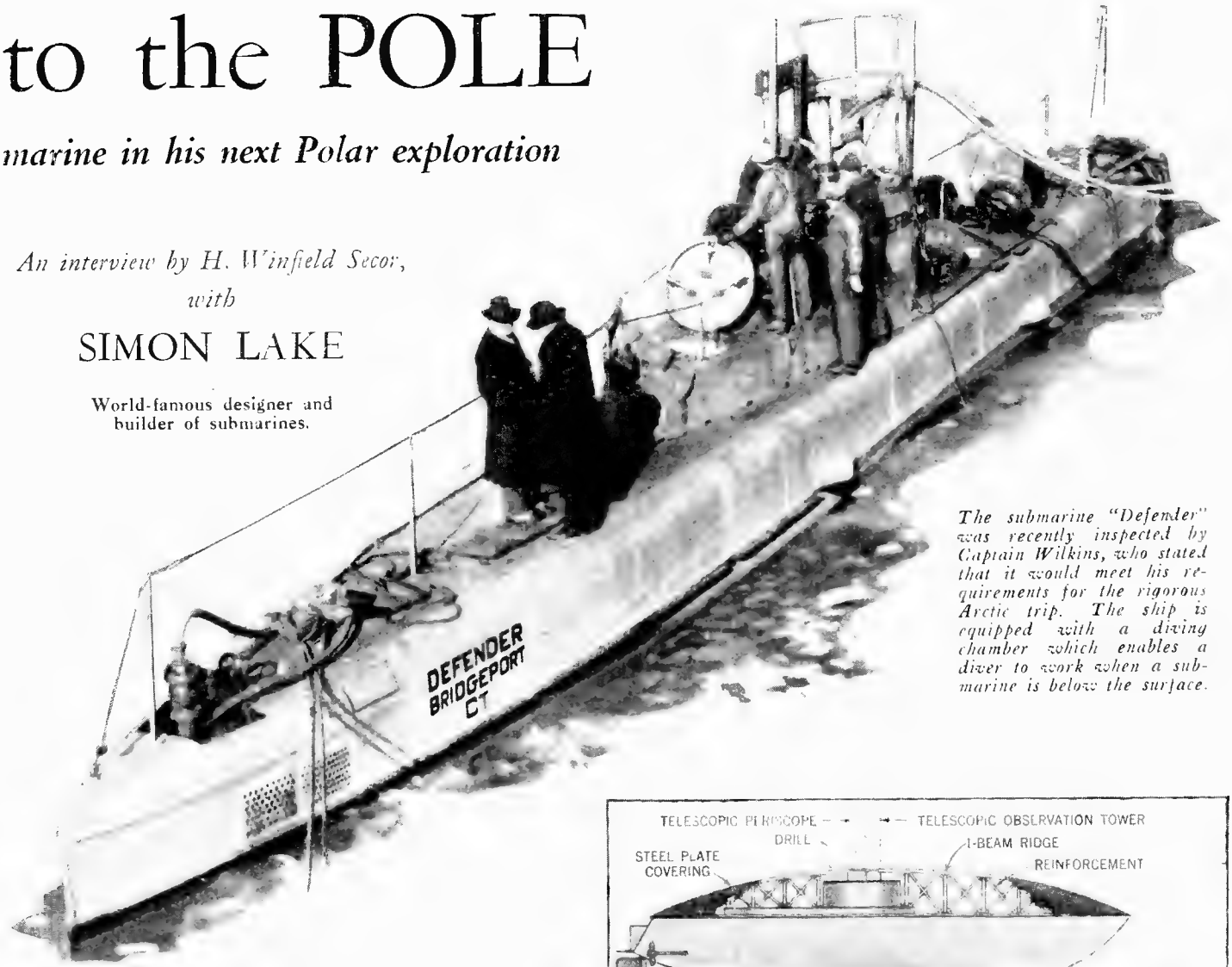
to the POLE

marine in his next Polar exploration

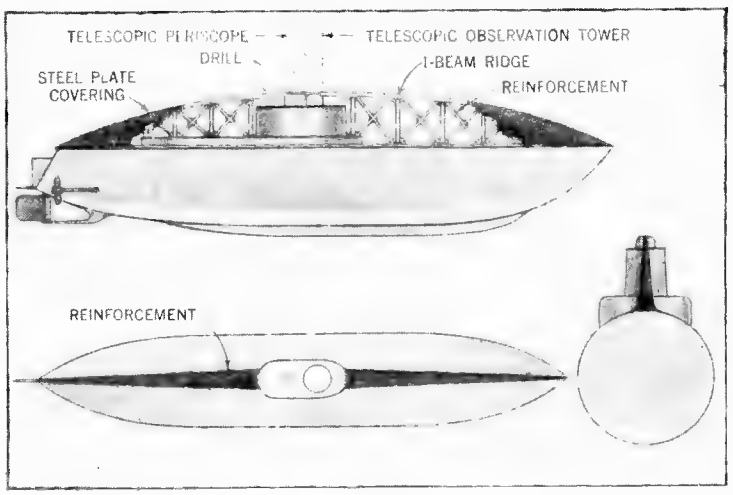
An interview by H. Winfield Secor, with

SIMON LAKE

World-famous designer and builder of submarines.

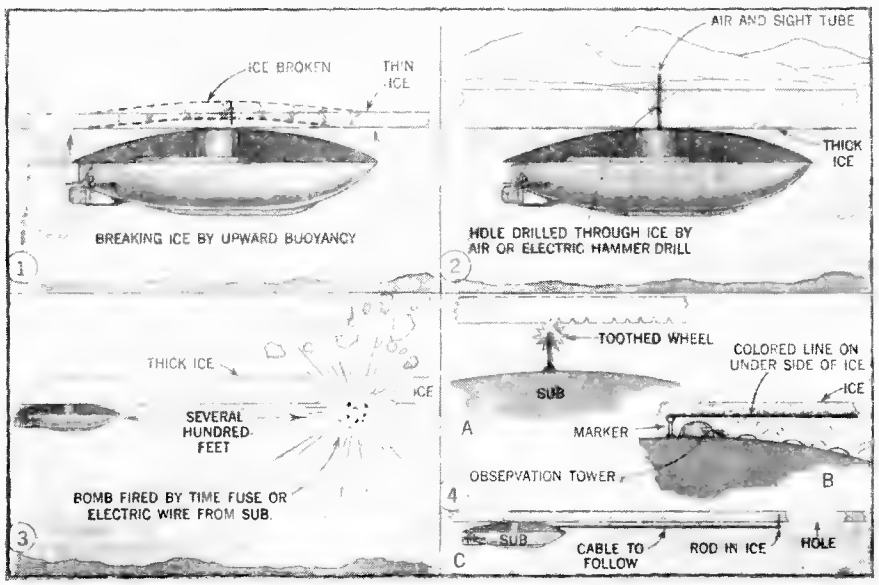


The submarine "Defender" was recently inspected by Captain Wilkins, who stated that it would meet his requirements for the rigorous Arctic trip. The ship is equipped with a diving chamber which enables a diver to work when a submarine is below the surface.



The illustration at the right shows a side, top and front view of the submarine. The top of the ship will be strongly reinforced and covered with a heavy steel plate.

The drawing below shows a number of ways in which the ice blanket could be broken. Thin ice might be crushed merely by allowing the submarine to rise, relying upon the upward buoyancy to break the ice, as illustrated in figure 1. Figure 2 illustrates the manner in which a hole can be drilled in the ice, so that the air and sight tube may be used. Thick ice would have to be blasted. The bomb could be fired from the ship as shown in figure 3. After the ice had been broken, the submarine could find its way to the hole by one of the methods shown at A, B and C, figure 4.

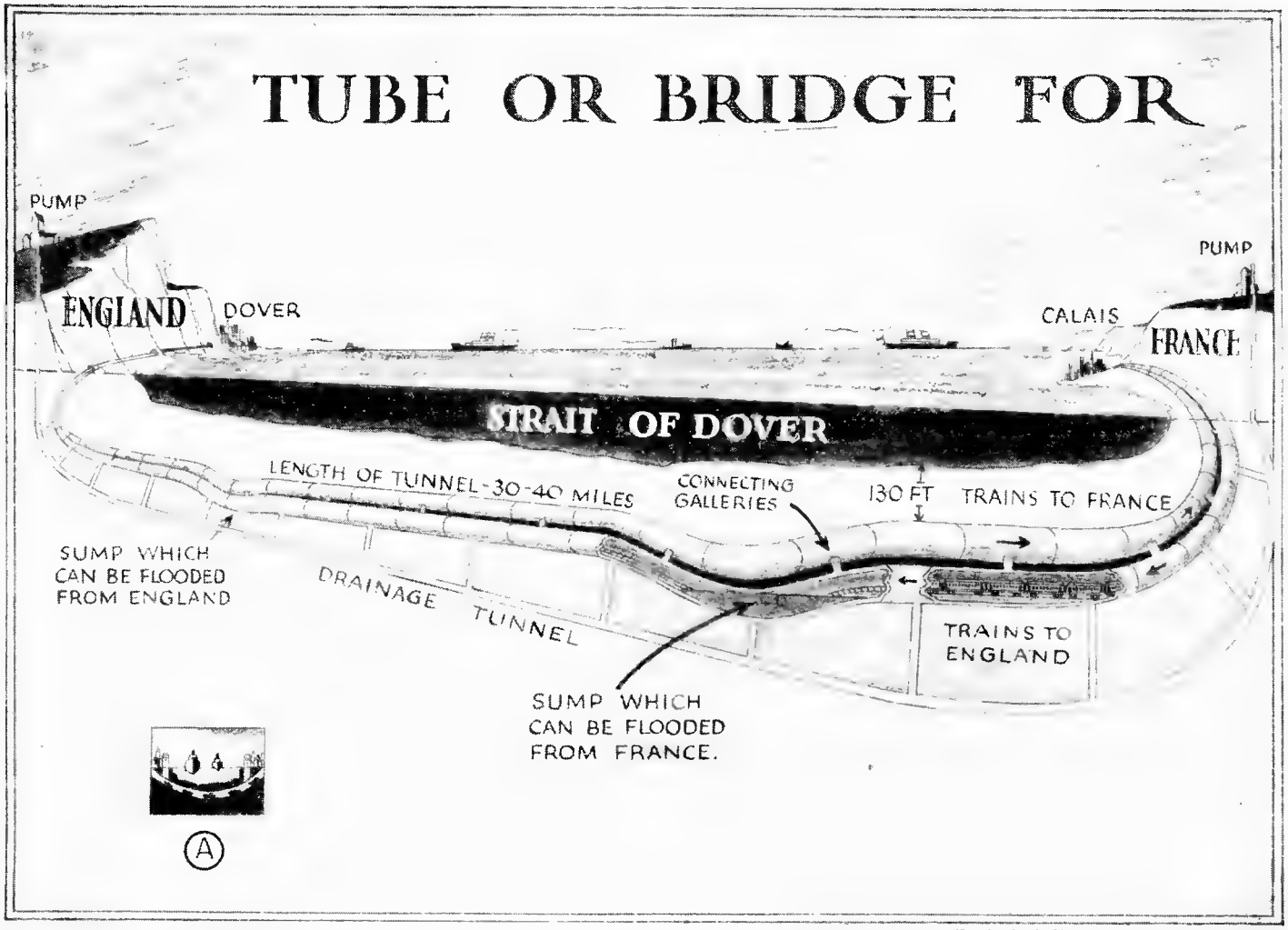


conning tower. The periscopes and observation tower, Mr. Lake enlightened me, will be made telescopic, so that when the submarine has to buck upward through ice, she will present a smooth contour and no delicate parts will be exposed which might be broken off.

Diesel Engines to Be Used

AMONG other changes in the equipment of the "Defender" for the polar exploration trip contemplated by Captain Wilkins, her present gasoline engines will be taken out and Diesel engines substituted. As the veteran designer and builder of submarines explained, this change in engines will give the "Defender" a cruising radius of approximately 3,000 miles at a speed of four or five knots, while the installation of a new set of storage batteries will give her a submerged cruising radius of 100 miles and possibly more, at a speed of three knots.

It is contemplated to install an up-to-date radio transmitter and (*Continued on page 276*)



Courtesy "London Daily Mail." Redrawn by our artist.

The above illustration shows the tube under the Strait of Dover. Longest present-day all-under-water tube shown at A.

A Channel Tunnel or a Bridge to Join France and England and a Tube to Connect Africa with Europe

TWO monumental ideas have been advanced for connecting France and England. The first proposes the building of a tunnel under the Strait of Dover and the second proposes a bridge across the English Channel. A tunnel or tube under the Strait of Dover would have to be 30 to 40 miles long, which is a far greater length than has ever been tunneled before. It is the intention to locate the English entrance in the hollow known as Winless Downs, under the western heights of Dover. From this place the tunnel would sink in a wide curve, straightening out to pass under the channel beneath the western end of Shakespeare Cliff. On the French side it has been planned to leave the main Paris-Calais line at Marquise, halfway between Boulogne and Calais, and to carry the approach line to Wissant on the coast.

The illustration given here shows a section of the proposed channel tunnel. The present plan calls for two tubes, with connecting galleries and sumps so that the tunnel could be flooded in time of war.

Bridge

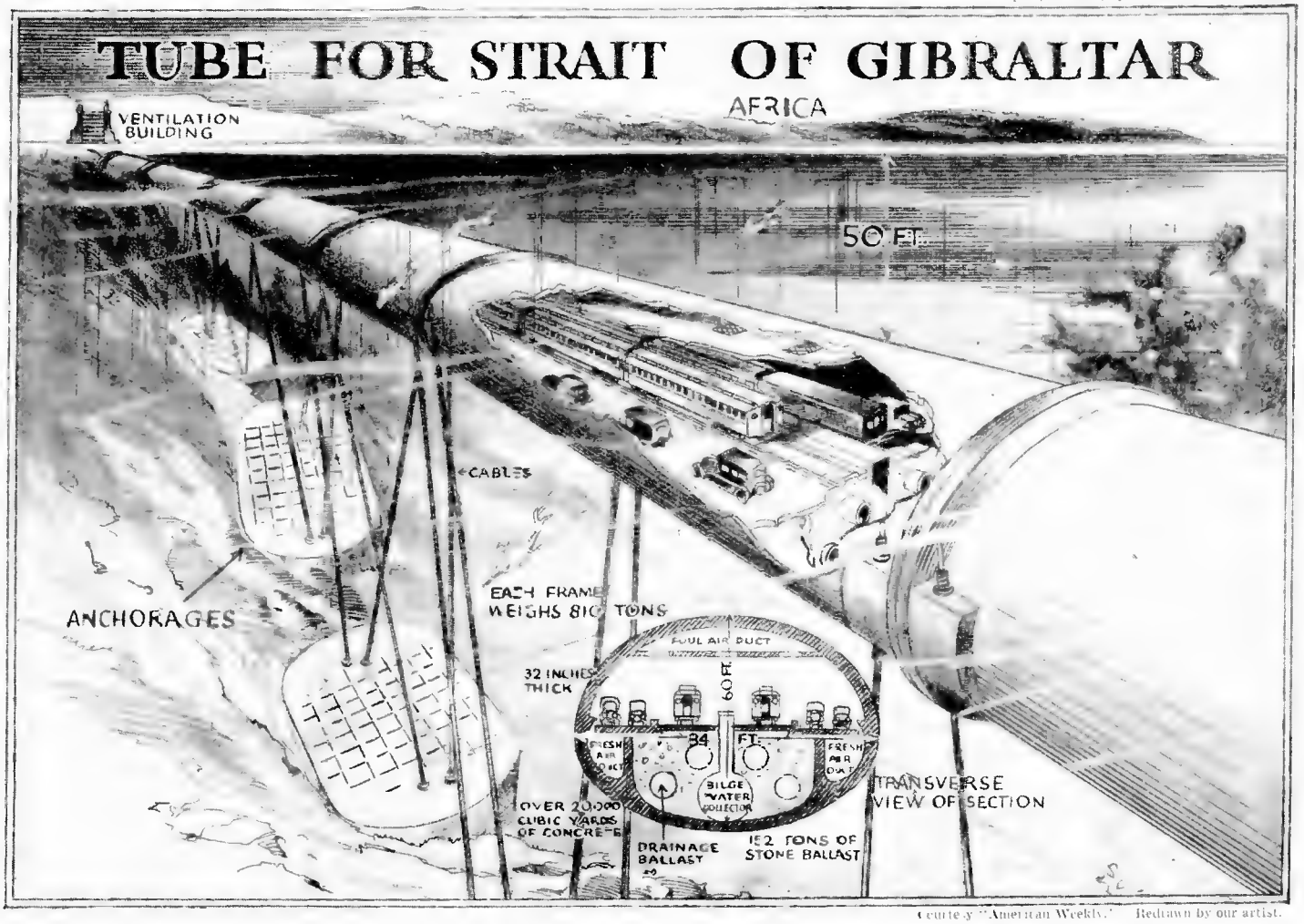
THE bridge proposal is more daring and necessitates the creation of two artificial islands upon sand bars. The total cost of this project would amount roughly to $410.000.000. This would be met by the sale of land on the islands constructed from the sand bars which now are situated at a point 9.6 miles off the coast at Cape Gris Nez. The illustration shows the approximate size of the islands when completed. The first island would be 9.6 miles long and the second 4½ miles long. It is claimed that the depth of the channel is not too great to make the construction practical.

Anchored Tunnel for Africa

THE joining of Europe to Africa by a tube across the Strait of Gibraltar is now being seriously considered. The cost is estimated at about $60.000.000, which is trifling enough, considering the results such a tunnel would achieve.

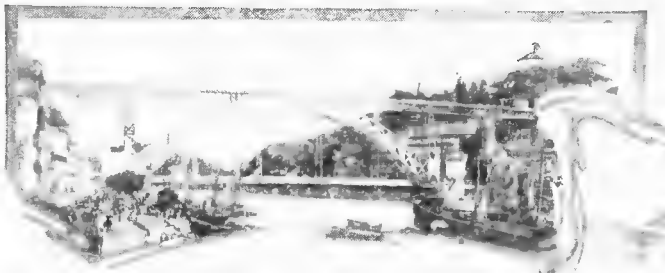
The scheme is in accordance with up-to-date engineering methods. An elliptical tube would be laid diagonally across the strait at a depth of 50 ft. below the surface of the water. This avoids the difficulty of laying a tunnel beneath the bottom of the strait, which in some places is 3.000 ft. deep. The Gibraltar tunnel design comprises steel sections, each 650 ft. in length with a width of about 84 ft. and a height of 60 ft. The entire structure will consist of 75 of these elliptical cylinders. The designer estimates that there will be a flotation force of 80 tons for each linear three feet. Each individual section floated to position and sunk will be anchored to the bottom by means of heavy steel, rust-proof cables. The cables will be attached to huge anchorages of reinforced concrete, each of which will displace 10.000 tons of water while afloat. It is calculated that the cables will not stretch more than 10 inches under the pull of buoyancy and the influence of the currents. The completed tube will be nine miles long and will contain two railroad tracks and four roadbeds for vehicles. The approach to the tube is designed to be nearly 1¼ miles in length with a 2 per cent. grade. It is estimated that by 1935 the tunnel could be ready for traffic.

Copyright 1929, by "Science and Invention"

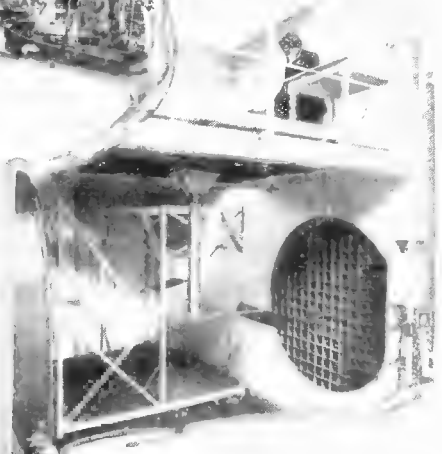


Courtesy "American Weekly." Redrawn by our artist.

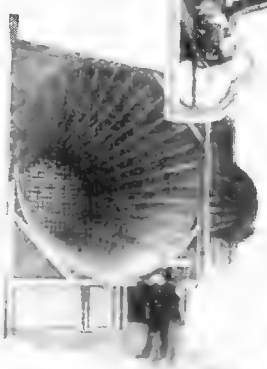
Alexandre Gustave Eiffel *and the* Eiffel Tower



Eiffel was the first one to use the style of bridge construction indicated in the photograph here. This photograph is from the original files and was taken in April, 1887.



A view in the experimental laboratory of M. Eiffel. This shows the room containing the wind tunnel with an air-foil surface directed against the wind and the pressure on the surface being measured by him on the platform above.



A rare photograph taken in the laboratory where he measured the efficiency of propellers. This shows Eiffel at one end of his wind tunnel.

ALEXANDRE GUSTAVE EIFFEL, the eminent French engineer, was born at Dijon, December 15, 1832, and died on the 27th of December, 1923, at the age of 91, after a magnificent life's work which brought him world fame. Although Gustave Eiffel is noted more because of the famous Eiffel Tower, one of the great wonders in engineering which was erected by him, his work in other fields has been as monumental. In 1858 he constructed the Iron Bridge over the Garonne at Bordeaux, and later the lofty and graceful bridge over the Douro at Aporto. The viaducts of Garabit and of Montluçon were also built by him.

How many of us know that it was this same genius who built the framework for Bartholdi's statue of "Liberty Enlightening the World," which welcomes those coming into New York harbor? Thereafter the Eiffel Tower was built by him, and at its completion he was made an officer of the famous Legion of Honor.

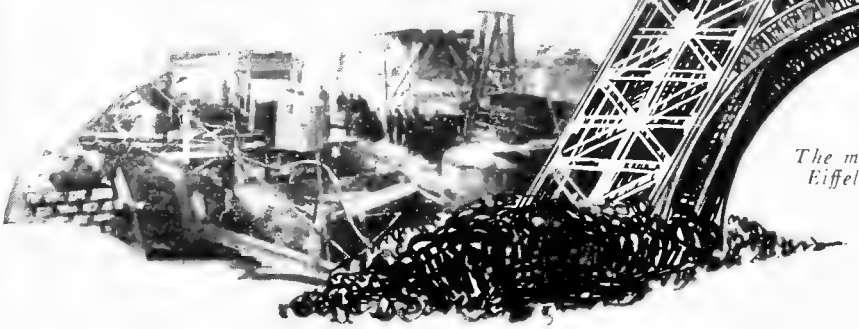
Alexandre Gustave Eiffel, who continued his scientific researches until the time of his death. This photograph was taken during the latter years of his life.

Eiffel's Memory to Be Honored

ON the 29th of April the city of Paris honored the memory of Gustave Eiffel by erecting a bust of the builder of the tower on a huge pedestal of granite masonry. This monument was placed at the foot of the north pillar of the tower.

In the latter days of his life, Eiffel worked tirelessly in a well-equipped laboratory on the Champs de Mars, and in 1913 he published his work on the resistance of air. This was at the time of its publication the most systematic discussion and the most authoritative source of information on the problems of aerodynamics since the classic researches of Langley in 1891. It afforded aero-

Here Gustave Eiffel is seen at the age of 26 at work with his aerodynamic balancer, which he invented. This balancer assists in the calculation to a small fraction of a pound of the pressure against an air-foil surface mounted on another portion of the apparatus and acted on by the wind.



Sinking the huge caissons in May, 1887, for the foundation of the tower.

The magnificent Eiffel Tower.

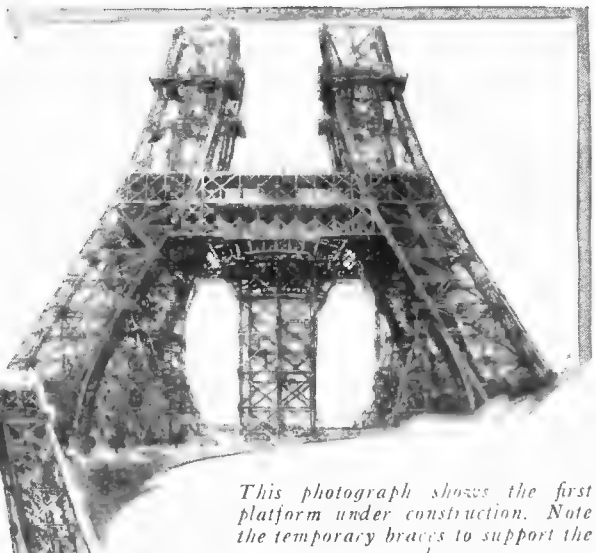
FRANCE HONORS EIFFEL

In memory of their beloved engineer, who was responsible for the building of the Eiffel Tower in the face of great odds and public ridicule, France has just erected a fitting monument, dedicated to Alexandre Gustave Eiffel, at the foot of the Eiffel Tower

France Honors Memory of the Famous Engineer Genius Whose Tower Is Only One of His Many Contributions to Science

By COUNT A. N. MIRZAOFF

nautical engineers data of greater accuracy than they were ever able to secure previous to that time. In this laboratory there were air tunnels in which the effect of air current from power-driven fans could be studied and in which the action of air currents on air-foil surfaces could also be observed and calculated. The photographs on these pages are from a collection in the library and the private office of the great engineer which was in the Eiffel Tower, 285 meters above the streets of Paris. Many of them have never been published heretofore. Not only do they disclose the stages in the building of the Eiffel Tower, but they also show some of the other work with which this eminent engineer was connected.

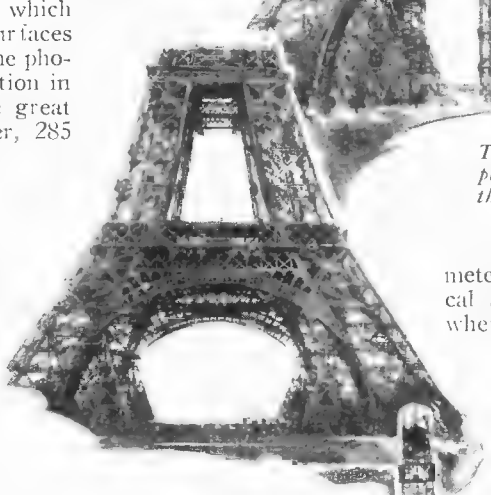


This photograph shows the first platform under construction. Note the temporary braces to support the arch.

The Eiffel Tower

IT would not be amiss to mention a few facts concerning the Eiffel Tower, the colossal structure erected in the Champs de Mars, which was completed on May 31, 1889, in time to serve as one of the notable features of the exposition held in that year. As can be observed in the photographs, the lower portion of this tower is built up of four iron columns, each of which consists of four smaller columns resting on stone piers. The supporting base is 330 feet square. The main columns curve toward each other and unite in a single column 620 feet above the ground. At the same time, arches of steel connect the piers. The Eiffel Tower contains three platforms, one 189 feet above the street level, the second 380 feet and the third at a height of 906 feet. These platforms may be reached by elevators as well as by stairs. In each of the four piers there are elevators. Two of these run to the first platform and the other two stop at the second platform. A third set of elevators runs between the second and third platform, or a distance of 526 feet. This set is divided into two portions, one of which makes half the distance and the other the remainder. American-made elevators run from the ground to the second platform. Above the third platform there is a spiral stairway running to the top of the tower, which staircase is not open to the public.

On the first platform there is a floor space of nearly an acre, and at the time of the exposition four restaurants were located there. Searchlights are mounted near the top of the tower, where there is also a meteorological observatory, a physical and biological laboratory, and where the radio antenna for sending out the daily time signals is attached.



In July, 1888, the second platform was finished. This is the way the Eiffel Tower looked at that time. The arch braces have been removed.

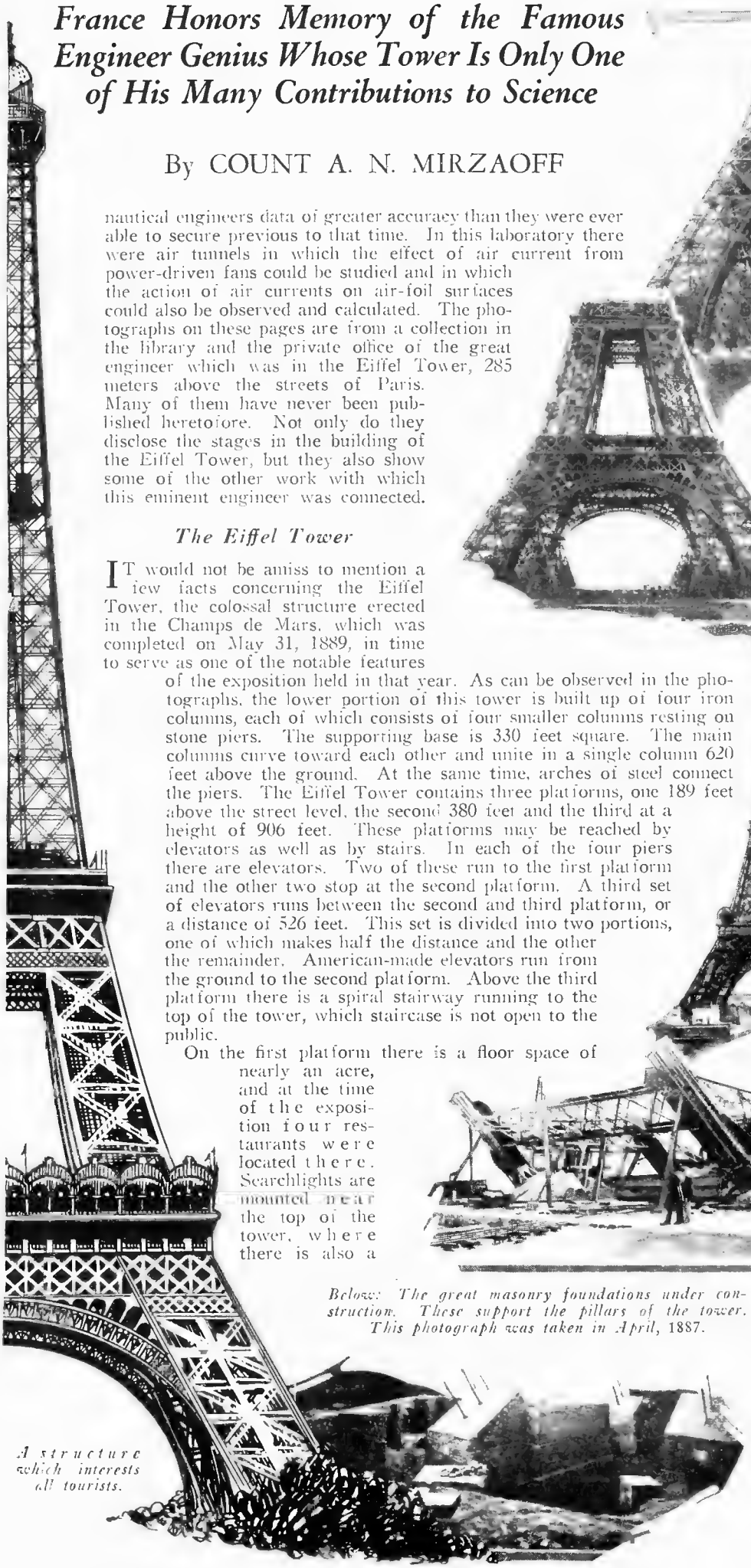
If one should look out from the top of the tower, he will find that on a clear day his vision is unobstructed for a distance of about 85 miles.

In the construction of the tower about 7,000 tons of steel were used and the expense of its construction was considerably over a million dollars. The French Government voted about $292,000 and the remainder was of course supplied by M. Eiffel. Reimbursement was to be obtained by the charging of admission to the tower, and he was entitled to the profits of such sales for a period of 20 years. The profits for one year alone nearly paid for the total cost of the tower.

The three platforms were finished in 1889. The top is shown as not yet completed.

This photograph shows the construction of the piers and the first portions of the metallic work.

Below: The great masonry foundations under construction. These support the pillars of the tower. This photograph was taken in April, 1887.

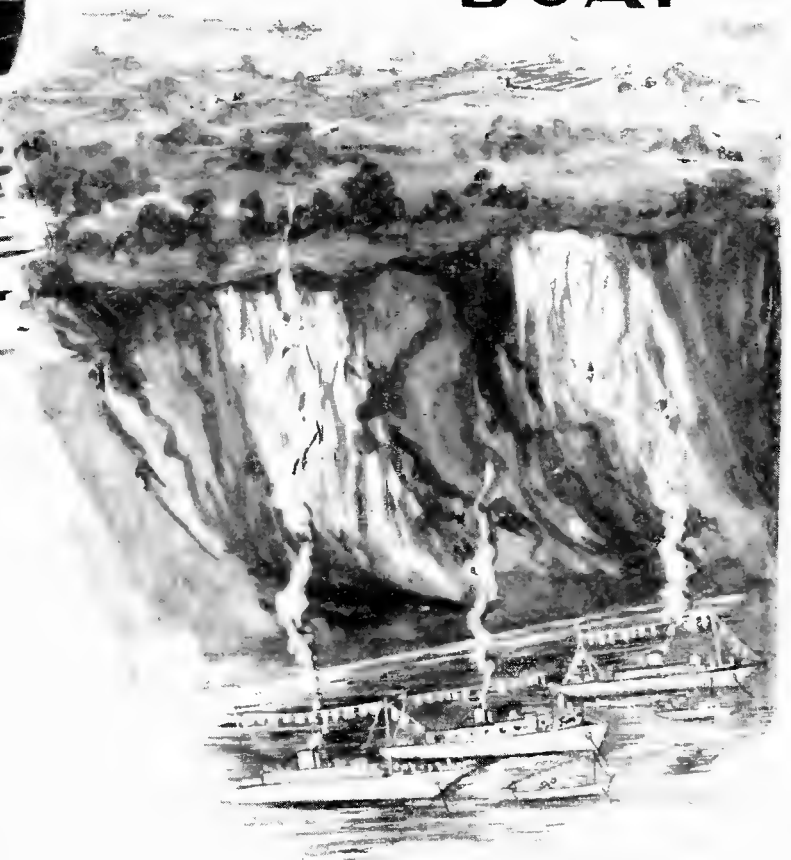


A structure which interests all tourists.

As with other famous inventors, Gustave Eiffel found that considerable objection was raised to his scheme when it was first proposed, and even while the work was going on there was much opposition to the construction of the great tower.

AIRPLANE REPORTS BOAT

The above photograph shows the Spirit of Atlanta, piloted by Julius Herbst, who won the Class D outboard trophy.



THE outstanding outboard racing event for the season was won this year by Jacob Dunnell of Boston, driving a Ludington hydro, equipped with a big Johnson 32 outboard engine. Dunnell covered the 132¼-mile course, from the Albany Yacht Club to the Colonial Yacht Club, in 3 hours, 36 minutes and 40 seconds. This established a new record for the course, last year's race winner doing it in 4 hours, 27 minutes and 30 seconds. Dunnell averaged 37.4 miles an hour for the distance.

Airplane Reports Results

AN airplane equipped with a short-wave radio transmitter reported the progress made by the boats as it flew down the Hudson River toward New York City. These short-wave signals were picked up by a set in the Radio News Laboratories and at station WRNY, in the Hotel Roosevelt, in New York City. The results of the race as received at this station were then broadcast on the regular wave-length, so that listeners were apprised of the result of the race almost as quickly as if they had themselves been at the finish line. This is the first time that such a stunt has been tried, and the results have been so gratifying that we may expect a greater usage of this method of reporting boat races in the near future.

The illustration at the right shows a view in the studio at WRNY, where the messages broadcast by the Pilot Electric Mfg. Co.'s plane were received.

In all there were some 200 entries, and of these 130 started and 56 finished. The others were forced out by engine trouble, driftwood in the river or running aground on the mud flats that extend some twenty-five miles down the river from Albany.

The Albany-New York Marathon, as it

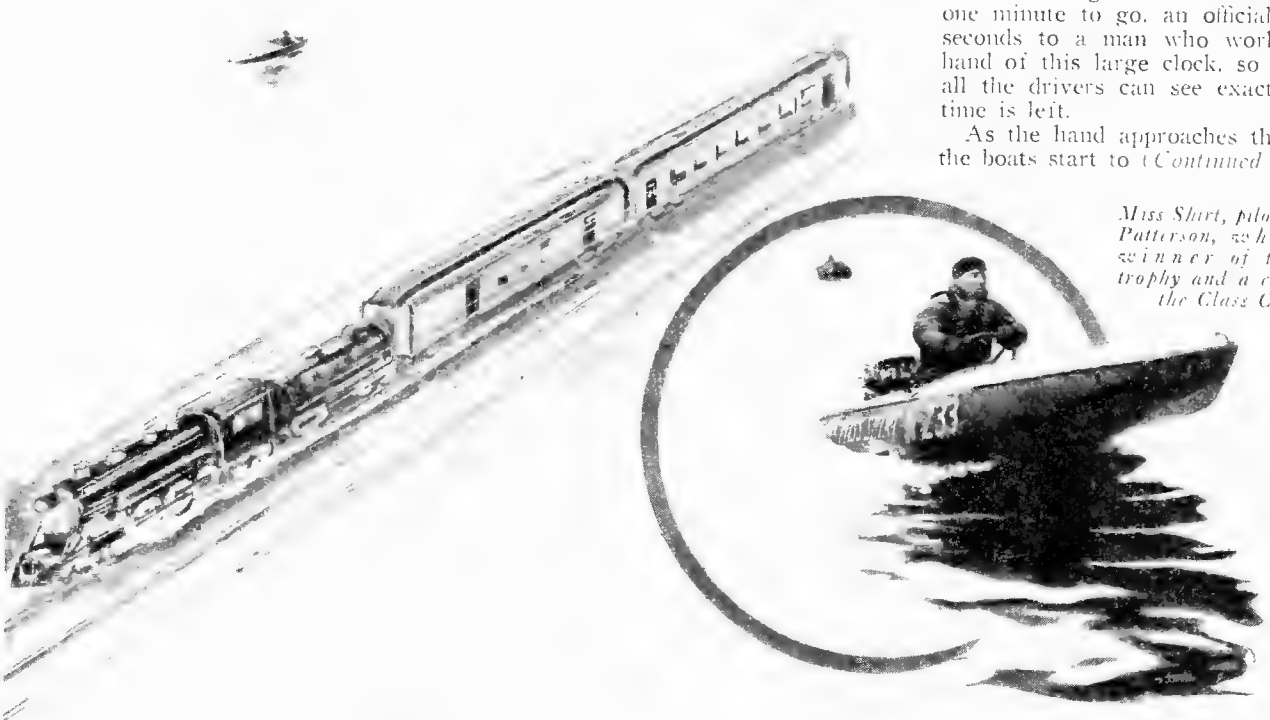
RADIO ~ OUTBOARD RACES

By WILLIAM F. CROSBY

is called, is fast becoming the real proving ground for the newest outboard boats and engines, the manufacturers of course offering every inducement to pilots in order to have them finish well up in the lead. Next year, officials expect to see more than 200 starters, and it is planned to run the race a few weeks later in the season in order to give more time for tuning up.

Dunnell actually started four minutes behind the "gun" at Albany, but forced his way through the fleet to come in a winner by nearly ten minutes. These races are started in a rather unique way by means of a huge hand-operated clock. A preparatory gun is given five minutes before the starting time and the race boats circle around in back of the starting line. When there is exactly one minute to go, an official calls off the seconds to a man who works the second hand of this large clock, so arranged that all the drivers can see exactly how much time is left.

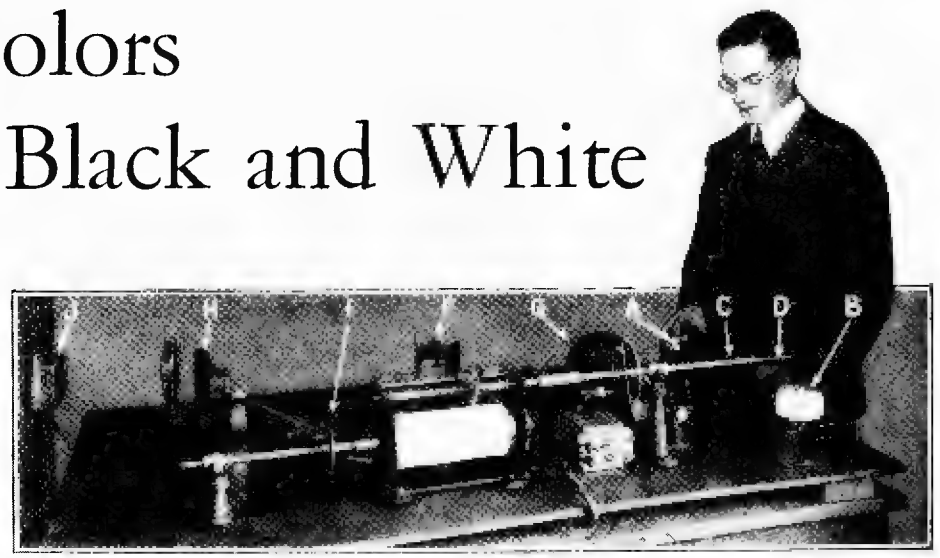
As the hand approaches the sixty mark, the boats start to (*Continued on page 282*)



Miss Shirt, piloted by E. H. Patterson, who was the winner of the yachting trophy and a cash prize in the Class C novice.

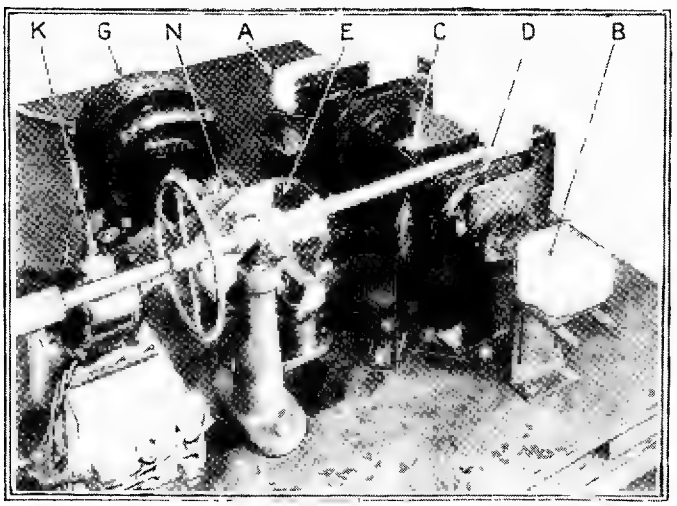
THE outstanding outboard racing event of the year was the Albany to New York race. An airplane equipped with a short-wave radio transmitter broadcast reports which were received at station WRNY, from which station listeners were apprised of the progress of the race on broadcast wave-length.

Recording Colors in Black and White



With a new recording spectrophotometer, the letters indicate: A, sample under analysis; B, magnesium carbonate standard; C, light source; D, shutter between light source and standard; F, spectrograph prism; G, synchronous motor which drives flicker disc; H, adjustable slit; I, cam for adjusting slit; J, entrance for a light to photo-electric tube and amplifier. Note drum on which record is made.

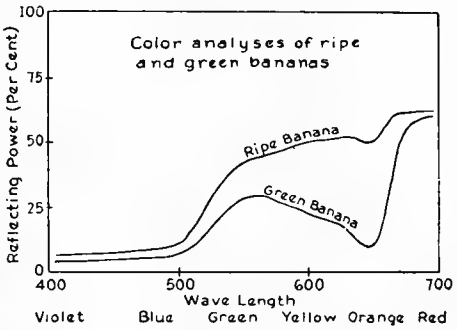
New Device Makes the Scientific Matching of Colors a Quick and Easy Process and Permits of Permanent Records of Colors



Illustrations courtesy General Electric Co.

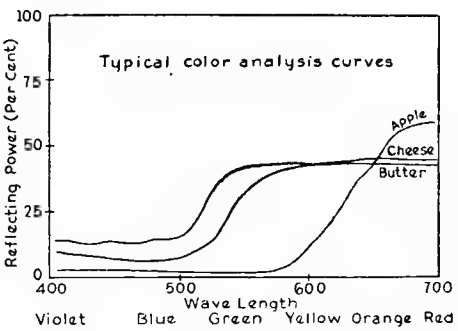
A close-up of the details in the upper photograph. Here E, the flicker disc operated by synchronous motor G, can clearly be seen. K is the synchronous motor driven by the amplifier, N is spectrograph slit No. 1. The other designations appear under the caption in the photograph above.

NO more will friend "Hubby" need to take a small piece of silk to a dry-goods store and stand at the ribbon counter for hours trying to match the sample, if the plan here illustrated is put in force in every store throughout the country; nor will New York have to wait for weeks before a new color originated by the fashion dictators of Paris arrives on this side for American duplication. A photoradiogram of the color scheme sent to New York will permit dye experts here to duplicate the original color or colors, even though they may never see the sample for quite a few days.

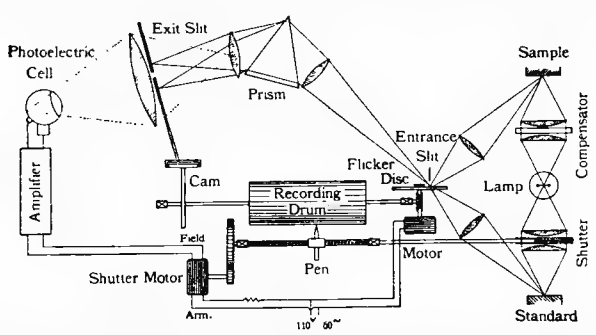


Can one banana be riper than another, both being green? The answer can clearly be given in chart form, similar to the diagram at the left. Note the difference between a ripe and a green banana.

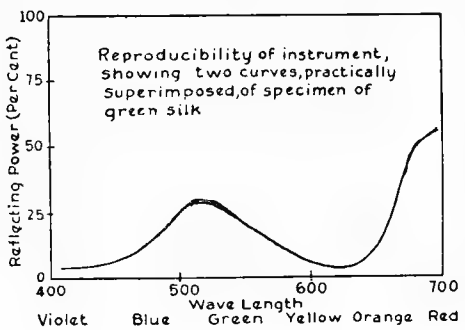
The actual color of the original oil paints used by the artists of two hundred or three hundred years ago is not known today. Perhaps those colors which we believe to be yellow were not originally yellow. Perhaps the color of Mona Lisa's hair was entirely different when it was originally produced, but how is anyone to know when there is no record of the color, and the description, regardless of how accurate that may be, would never serve the purpose? But with the new spectrophotometer, an instrument developed by Prof. Arthur C. Hardy of the Department of Physics at the Massachusetts Institute of (*Continued on page* 283)



What is the color of an apple, a piece of cheese, and butter? These are difficult of analysis, yet the spectrophotometer solves the problem easily.



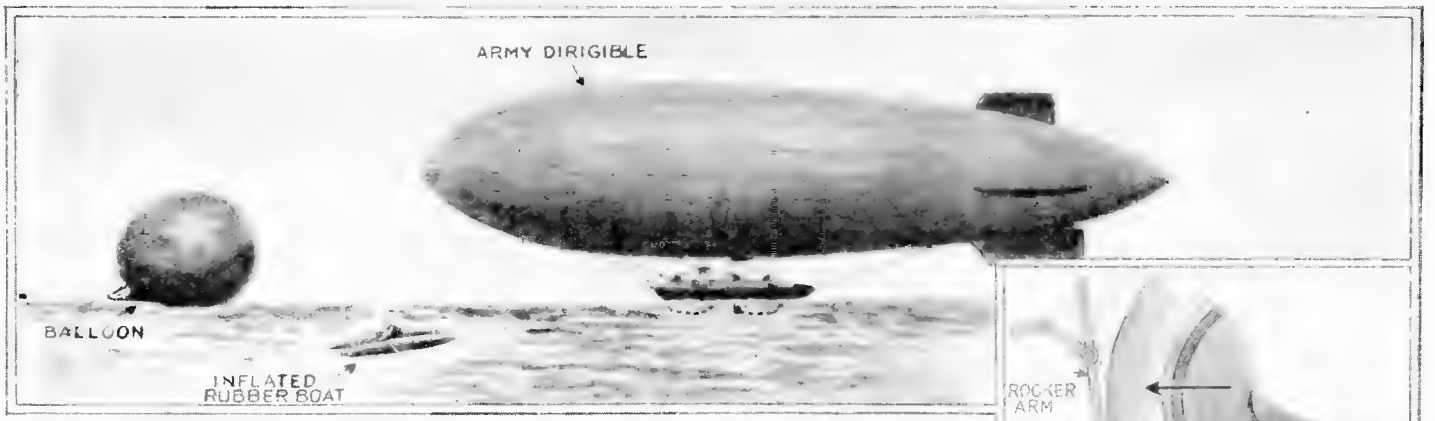
This diagram, made expressly for SCIENCE AND INVENTION, *shows the details of the operation. For further information as to how this works, we refer to the text.*



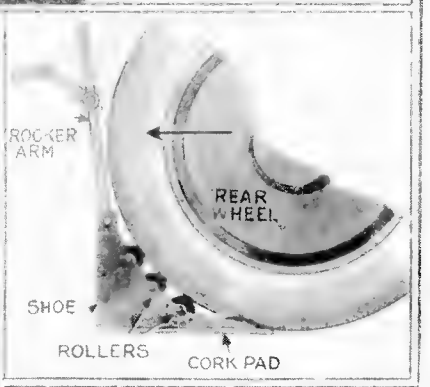
This illustration shows how it is possible to perfectly match two pieces of silk. Note that the two curves are practically superimposed. Such a black and white record can be kept for all time, and a thousand years from today it will be possible to match a color at any time.

The Month's Scientific News Illustrated

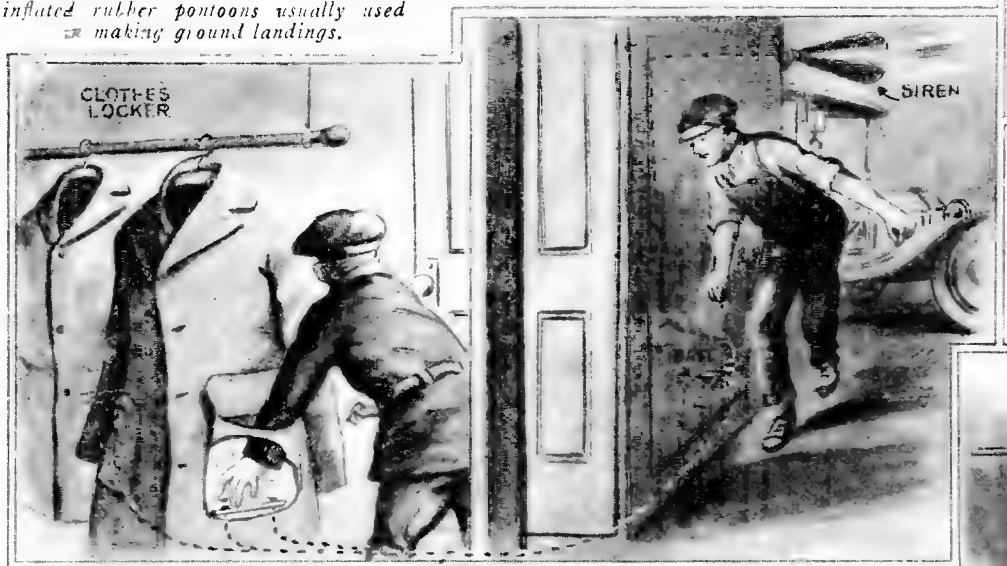
By GEORGE WALL



An army non-rigid dirigible recently made a landing on water in a test made to "rescue" a balloonist. The inflated balloon was taken to the middle of a lake with an officer clinging to it. The crew of the dirigible tossed a weighted rope to the officer with an inflated rubber boat attached to one end. The dirigible then settled in the water, being supported by two inflated rubber pontoons usually used in making ground landings.

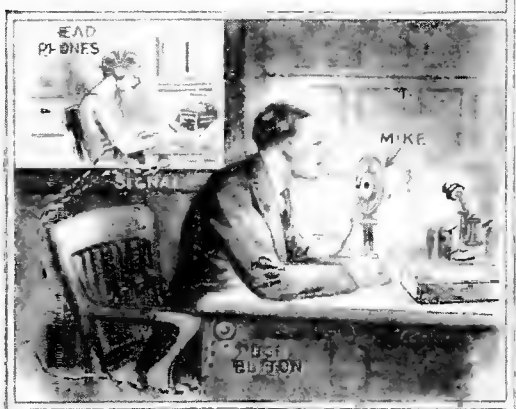


A device which will stop an automobile almost instantly has been perfected by a New Jersey inventor. It stops the vehicle by dropping under the rear wheels a shoe fitted with a cork pad to prevent skidding. The shoes are fastened on rocker arms and fit under the wheels.

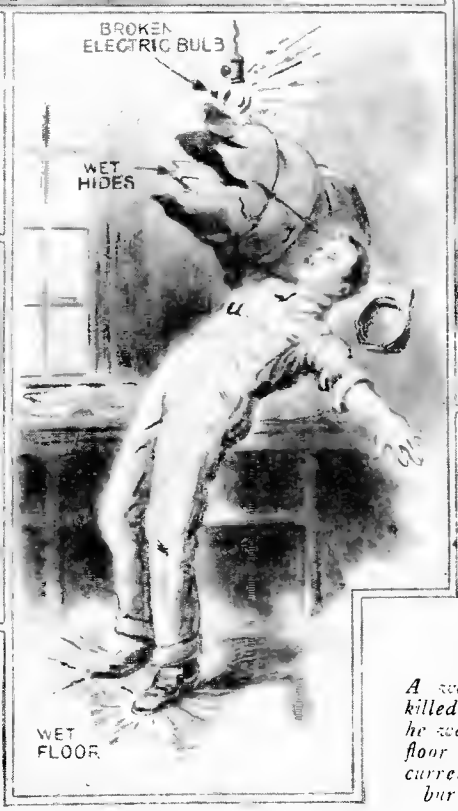


An enterprising garage owner has installed a siren in his garage and connected it by wire to all the pockets of coats and cash drawers in the locker room. A thief was caught only a few hours after the alarm system was installed. A device placed in the pockets closes the circuit when touched by the thief, thus sounding the alarm.

Holland Vehicular Tunnel collectors were recently insulated against static electricity. They had complained of shocks to their hands when collecting the tickets from the motorists. The cars coming down the steep hill to the tunnel collected a static charge. Rubber mats have been provided for the collectors. This condition is only found on the New Jersey side.



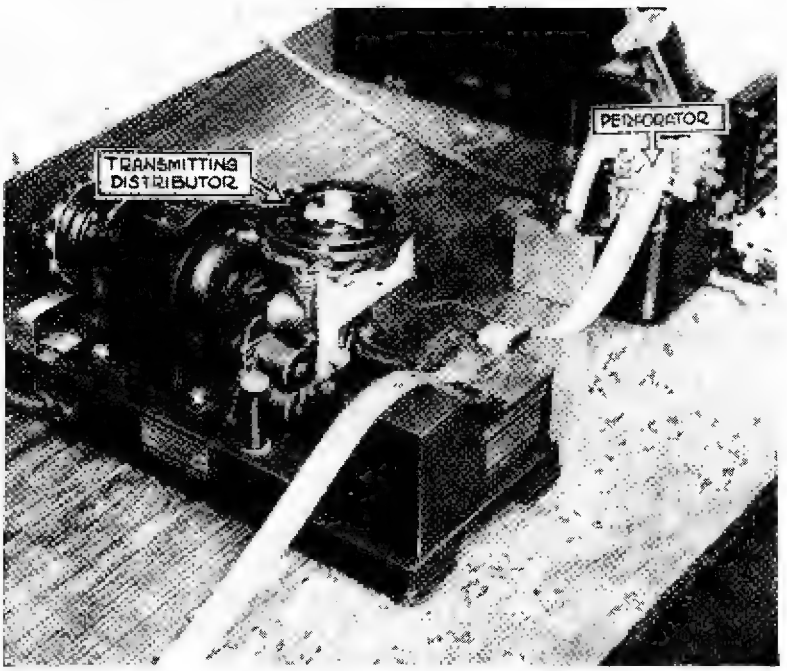
By installing a microphone and other associated apparatus in his desk, a sales manager in London dictates to his secretary in another room. When a letter is to be answered, he presses a button as a signal and the secretary dons a pair of headphones and can thus take down the letter without leaving her chair.



A worker in a Brooklyn packing company was killed recently when a bundle of wet hides which he was carrying broke an electric light bulb. The floor was wet as was the worker's body and the current entered his right arm which was badly burnt. The man was electrocuted immediately.

"Teletypesetter" Will Aid Printing Development

Simple Device Can Be Attached to Linotype or Intertype Machine and Will Set Type Automatically by Telegraph. Speed of Typesetting Greatly Increased by New Machine



A Narrow Strip of Tape Plays a Vital Part in Automatic Typesetter. Typist's Strokes Punch Holes in Tape and Set Linotypes Going

The transmitting distributor which sends out the message as perforated to distant receivers is shown above.

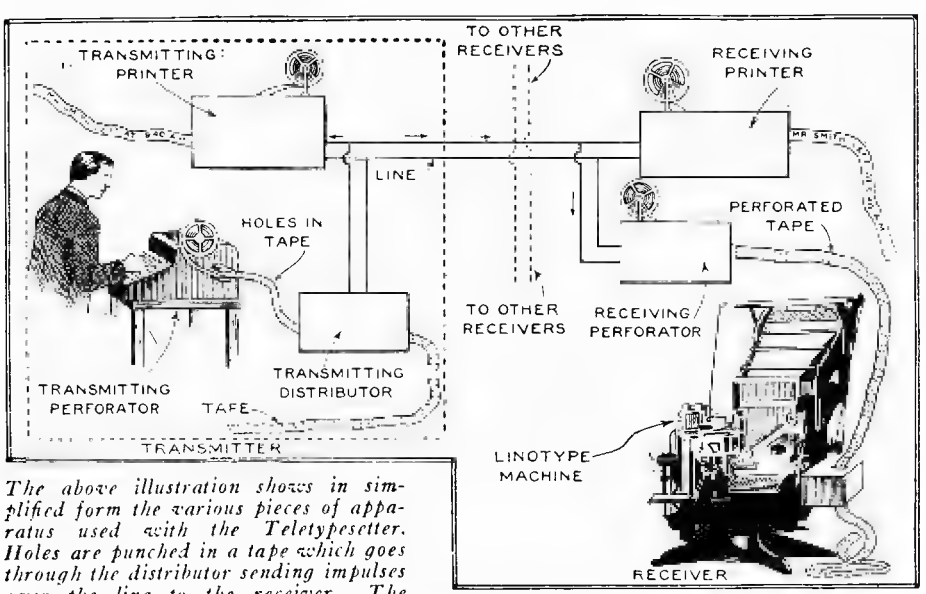
Setting Type *via* Wire

By PAUL L. WELKER

THE "Teletypesetter," a machine which sets type by wire, will enable a single typist to operate thousands of linotype or intertype machines in distant cities through the medium of this new almost human device. Speed has long been recognized as an important factor in the art of printing. History shows a constant effort to decrease the time of the mechanical processes, as the demand for the printed page increased. The first machine to set a line of type by mechanical means was invented in 1885 by Otto Mergenthaler. Improvements on this and the invention of other machines followed. With the invention of the teletypesetter, the speed with which type is now set can be greatly increased.

NEW INVENTION TO REVOLUTIONIZE PRINTING

THE invention of the teletypesetter, a device which will increase production of typesetting machines, is expected to greatly aid the printing art. The device enables type to be set automatically by wire, and one operator can control typesetting machines all over the world. The message for transmission is recorded on a tape perforated by a typewriter at the transmitting end. Experiments are now being made for operating the typesetting machines by radio.



The above illustration shows in simplified form the various pieces of apparatus used with the Teletypesetter. Holes are punched in a tape which goes through the distributor sending impulses over the line to the receiver. The receiving perforator punches holes in a tape which runs to the typesetting machine.

Perforated Tape

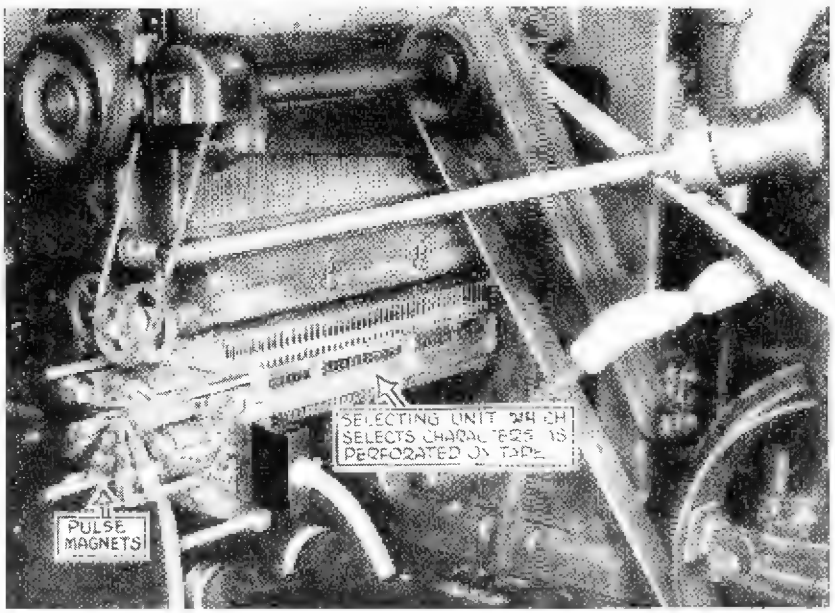
AN electric typewriter at the central news dispensing office perforates the tape, each group of perforations corresponding to a letter, numeral or symbol. The tape is led through the transmitting distributor and a series of dots corresponding to the holes in the tape are then sent over the wire in the same manner as code messages are transmitted. At the transmitter will be an automatic printer which enables the operator to read the message as it is being sent. At the receiver is a perforator which punches holes in a tape in exact duplication of those made in the transmitting tape. The transmitting station can be connected by wire to any number of receivers throughout the country, or for that matter, throughout the world.

Single Operator Controls Many Typesetting Machines

Single Typist Can Now Put Into Operation Machines Scattered Throughout the Country, Which Set the Type Without Human Aid

Receiver

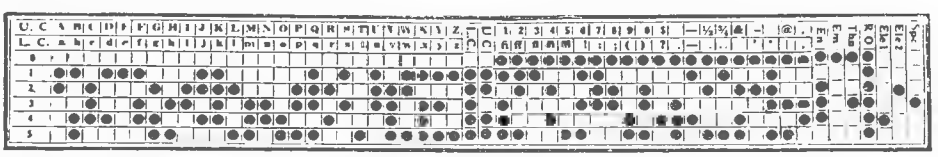
AT the receiver is an automatic printer which types the message as it is being received, at the same time that the receiving tape is perforated. The perforated tape at the receiver is then sent through a device attached to the linotype or intertype machine. Here, electrical impulses translate the code into depressions in the keys on the typesetting machine. Four or five typesetting machines in a plant under control of the teletypesetter may be operated by one mechanic. The mechanic sees that the machines are properly regulated.



The above photograph shows a close-up view of the selector unit which selects the characters as perforated on the tape. This unit acts as a linotype operator by releasing and setting the type.

Automatic Stops

AN automatic stop is arranged on the machine in case anything goes wrong. As the machine stops a red light flashes at the top, right-hand corner as a warning to the man in charge. The machine cannot be started again until adjustments have been made. Other devices, small units of the apparatus, prevent the tearing of the tape, and if any one of the units through which the tape passes should stop, the units beyond that point keep in operation until the tape is tightened. Metal arms extend over the tape as the latter enters the transmitting units, and as the tape tightens it raises the arms shutting off the power.

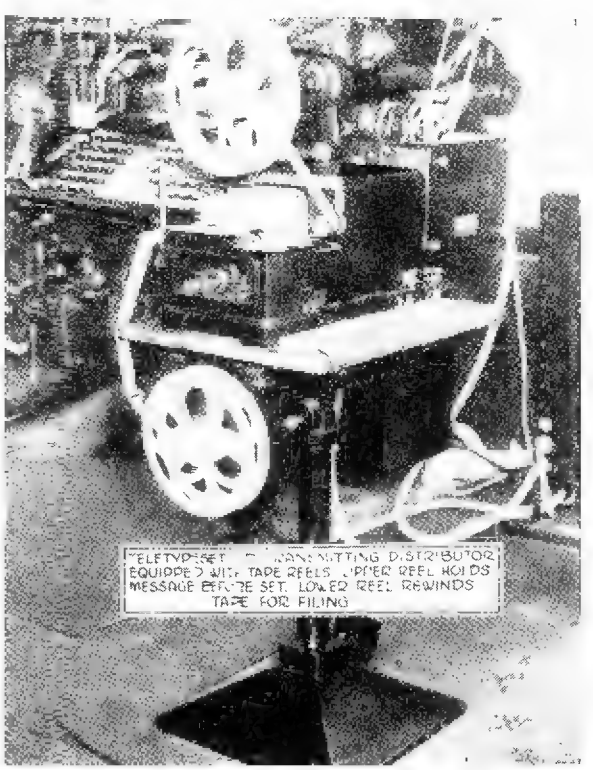


The perforated tape by which messages are sent through the transmitting distributor to distant points, is shown above. Not more than six perforations are needed for each letter. The holes in the tape represent letters, numerals or symbols.

Possibilities

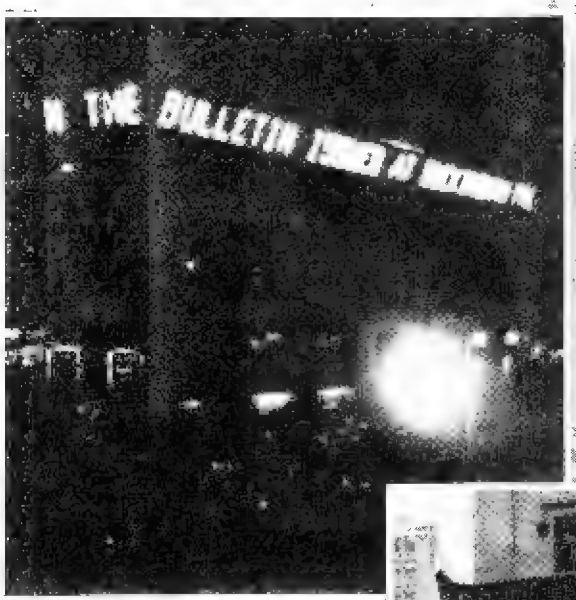
SYNDICATED matter could be furnished on perforated tape and this tape fed through the typesetting machines when it was desired to set the type. Not only can the Teletypesetter be used to transmit copy over long distances, but it might be employed in publishing plants for purely local work. The tape could be perforated and sent to the composing room for feeding through the typesetting machines. Experiments are now being carried out whereby the Teletype a machine which records automatically typewritten matter over long distances, may be operated by radio. Upon the perfection of this apparatus, it is reasonable to predict that the time is not so far distant when Teletypesetting units will also be operated by radio. Book publishers will no longer be compelled to keep tons of metal plates in their files for the printing of new editions. A small roll of tape will preserve each chapter until a new impression is made. Valuable time will be saved in the sending of market quotations, and by the time the last quotations are listed, the typist, operating the perforator, will be practically even with the quotations as they come from the floor of the Stock Exchange.

Several years ago, Mr. Frank E. Gannett, of Rochester, N. Y., owner and publisher of the Gannett newspaper chain, advanced the idea of apparatus which would set type by telegraph. Today, Mr. W. W. Morey, of East Orange, N. J., and the Morkrum-Kleinschmidt Corp. of Chicago, co-operating with Mr. Gannett, have actually perfected such a machine. Its application in all fields of printing and news-dispatching service is extremely wide. One or more of the automatic units, when used in conjunction with the typesetting machines, will replace a great number of linotype typesetting and intertype typesetting operators.


TELETYPESET TRANSMITTING DISTRIBUTOR EQUIPPED WITH TAPE REELS. UPPER REEL HOLDS MESSAGE BEFORE SET. LOWER REEL REWINDS TAPE FOR FILING

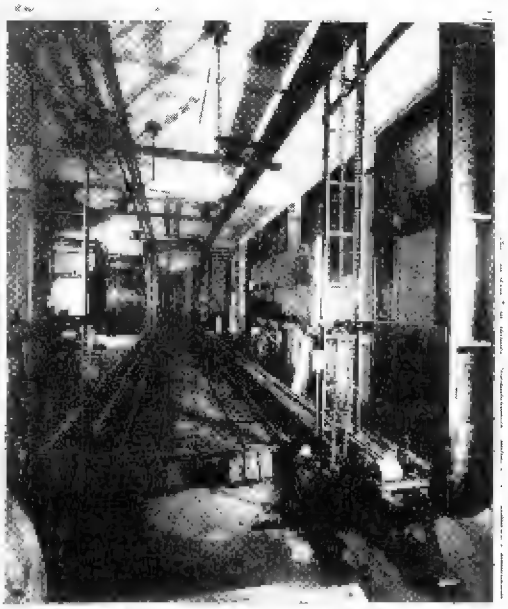
The above photograph shows the teletypesetter transmitting distributor, equipped with tape reels. The upper reel holds the message to be transmitted and the lower reel rewinds the tape for filing.

Moving Sign Flashes News



The above photograph shows the New York Times' *moving sign as it appears at night. Latest press news is flashed to the public in this manner.*

The three photographs appearing here show various views of the moving electric light sign which has been placed about the Times Building, at Times Square in New York City. The letters seem to move quite rapidly from right to left.

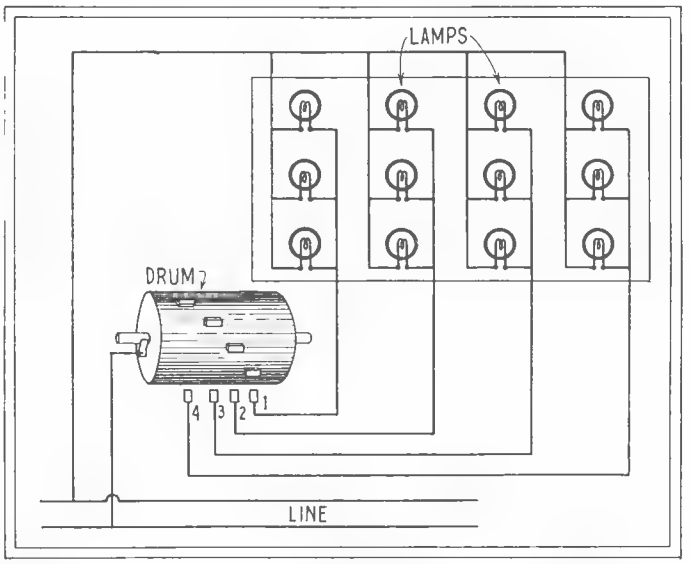


A view of the rear of the sign is shown. The complicated mechanism makes it possible to change the wording in a short time.

The sign as it appears in the daytime is shown in this view. It extends completely around the outside of the building.

AN electric sign with lighted letters moving before the reader is one of the most recent inventions, and constitutes a marked advance in advertising. One of the largest of these electric signs has been installed on the New York Times Building, at Times Square, in New York City. Latest news is flashed nightly to the huge crowds at the cross-roads of the world. The words follow each other around the entire four sides of the building and are large enough to be read at some distance. The wording is changed by means of the machinery shown in the rear of the sign. The front is entirely covered with rows of electric bulbs which successively light up, spelling out the words, which move from right to left, so that one can read the message without moving his eyes from a fixed point on the sign.

The diagram appearing on this page shows in a simple manner the mode of operation. A number of contacts on a revolving drum connected to one side of the line pass over stationary contacts, momentarily lighting one bank of lamps at a time. The diagram at the right is from the rear of the sign, and lamp bank No. 1 would be lit first, then 2, 3, 4, and so on, so that we would have the simple letter I moving from right to left. Of course, where many words must be spelled and these changed frequently, the mechanism employed for this purpose is extremely complicated. It is obvious that this could not very well be illustrated, and if it were, it is doubtful whether anyone would take the time and trouble to follow the intricate wiring and the various changes which take place.

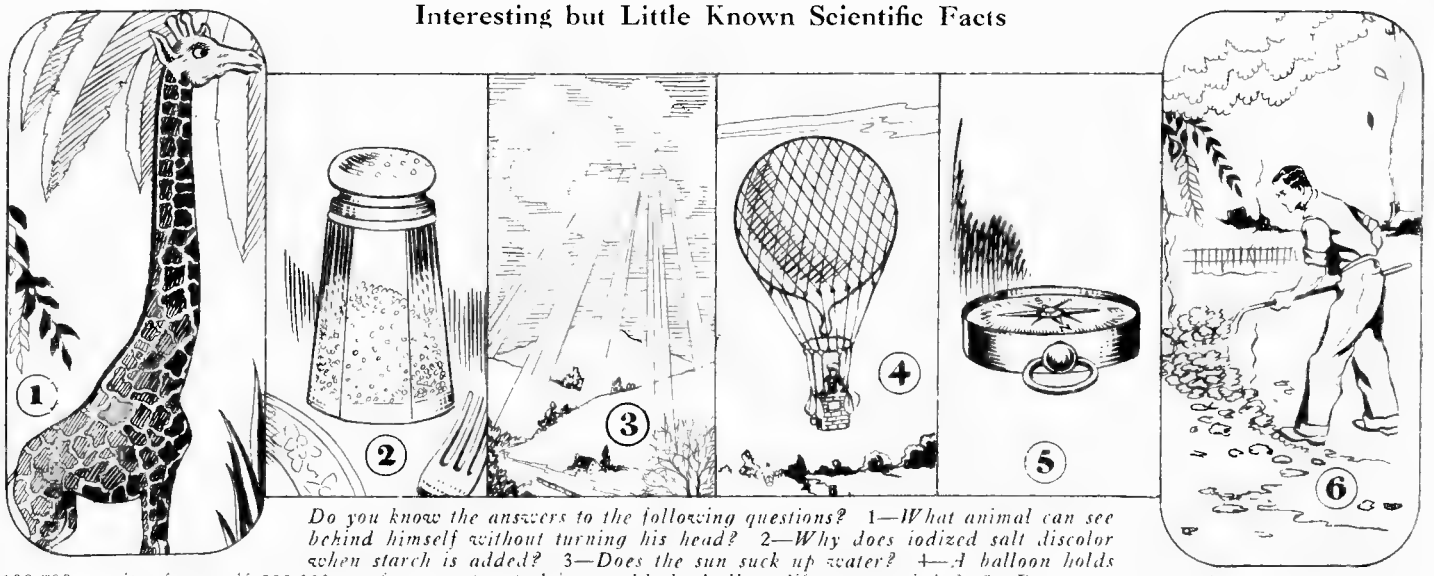


The above drawing shows in a simple manner the method of operation used in the moving sign. Banks of lights corresponding to the letters are lit in succession. In this case, the letter I would be shown and moved from right to left.

Persistence of Vision

THE words as they pass across the face of the sign appear to move smoothly. This is because of the phenomenon known as persistence of vision, without which our present-day television systems employing scanning discs would be useless. The eye has the peculiar property of retaining a certain scene for a short period of time, so that even though the process of changing from one bank of lamps to the next is a jerky one, the words appear to move smoothly. The same effect is present in the moving pictures, where about sixteen separate scenes are flashed upon the screen in a second, yet the action shows smooth and continuous.

Interesting but Little Known Scientific Facts

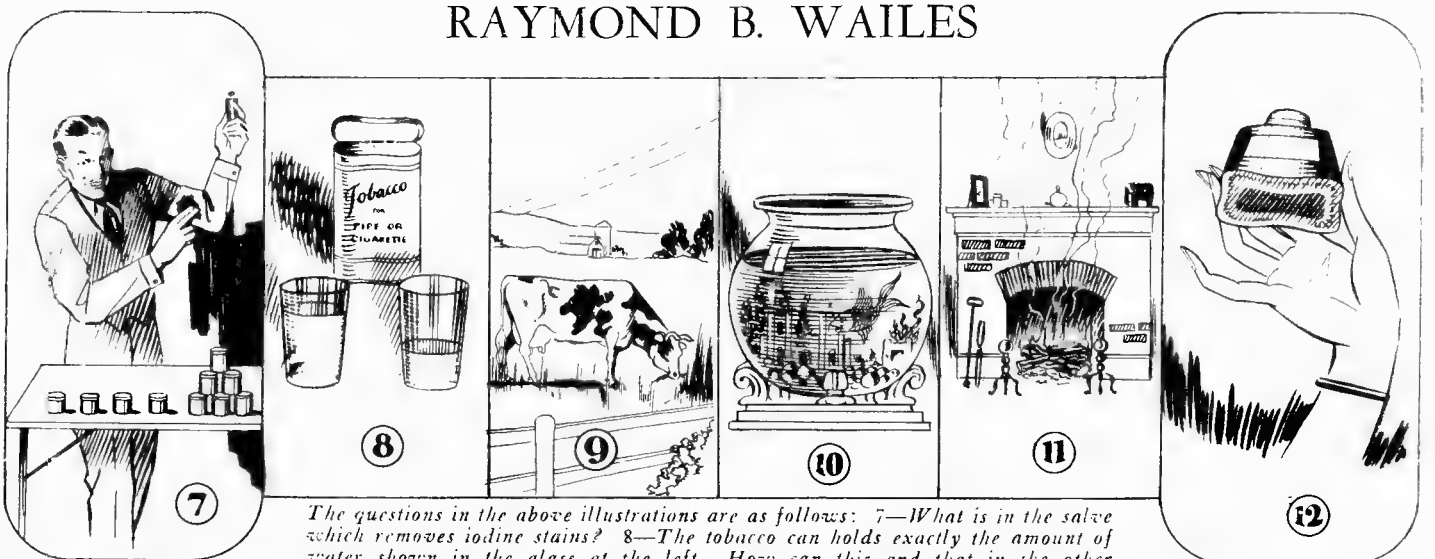


Do you know the answers to the following questions? 1—What animal can see behind himself without turning his head? 2—Why does iodized salt discolor when starch is added? 3—Does the sun suck up water? 4—A balloon holds 100,000 cu. ft. of gas; if 200,000 cu. ft. were pumped in, would the balloon lift more weight? 5—Does a compass point to the north pole? 6—Why shouldn't leaves, stems and the like be burned?

Odd Bits *of* Science

By

RAYMOND B. WAILES



The questions in the above illustrations are as follows: 7—What is in the salve which removes iodine stains? 8—The tobacco can holds exactly the amount of water shown in the glass at the left. How can this and that in the other glass be poured into the can without spilling? 9—How long does it take for milk to taste like garlic after the cow has eaten garlic tops? 10—Large pebbles should not be put in an aquarium. Why? 11—Does your fireplace smoke and draw badly? How can this be remedied? 12—Did you ever look at a flavoring extract bottle from the bottom?

THE answers to the above scientific oddities are given here. The numbers refer to the above illustrations.

1—The eyeballs of the giraffe protrude from the sockets to such an extent that this animal can see behind himself without turning his head.

2—When iodine and starch are mixed, a bluish-black color is produced and it is the decomposition of the potassium iodide which the salt makers add to their product which causes the discoloration when starch is mixed with salt to keep it from caking. It is not harmful.

3—The rays from the sun which are commonly believed to be water sucked up from the earth are caused by the sun shining through the dust of the air, each dust particle reflecting the light. The rays are not water.

4—No, for all gases have weight, and if twice as much gas were pumped in the balloon, it would become compressed and have this extra weight to carry.

5—A compass does not point to the north pole, as commonly believed, but instead, points to the north magnetic pole.

6—Piling leaves, grass cuttings, dead branches and the like and allowing them to rot will afford a rich humus in several months, or organic material for plants and flower beds.

7—Iodine removing salves contain photographer's "hypo," an inexpensive, harmless chemical. The removal of iodine stains by this substance is almost like magic.

8—Squeeze the can to make it round. Its capacity will be increased and the extra quantity of water may be poured into it.

9—One minute after a cow was observed to have eaten half a pound of garlic tops, its milk tasted garlicky. Even after smelling garlic tops for one minute, milk taken two minutes later tasted of garlic.

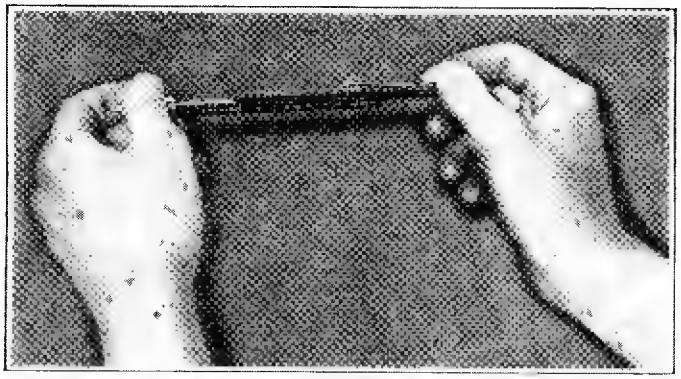
10—Food will fall between the large pebbles where the fish cannot reach it. Here it will become sour and turns the water milky.

11—If your fireplace is smoky this fault can usually be corrected by building the fire further forward. The strongest draft is toward the front of the andirons. Keeping the fire there will prevent much of the smoke. If the fireplace draws badly, this suggestion may help.

12—If a flavoring extract bottle is viewed from the bottom, it will be seen that there is very little inner space. The bottle is very nearly all glass and has thick walls. Although it apparently seems to be full, it contains much less of the fluid than you think you are getting.

LABOR and

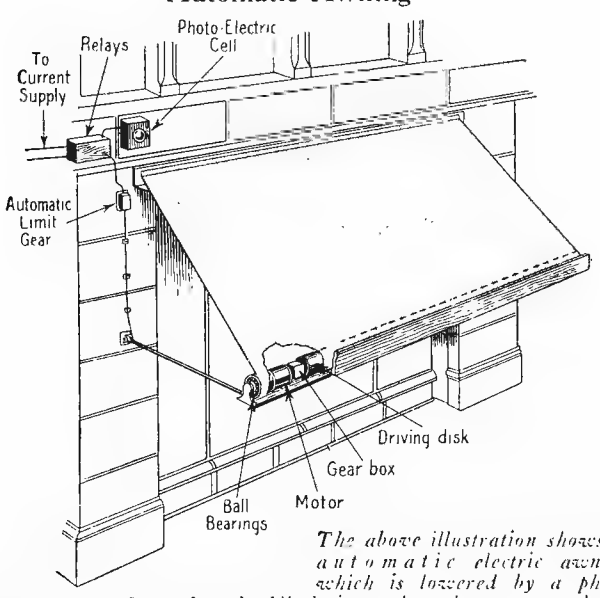
Slide Rule Pencil



The above photograph shows the slide rule pencil in use. The sliding scale multiplies, divides, and can be used to solve countless problems instantly.

The pocket calculator is no larger than an ordinary pencil, as may be seen above. The illustration below shows the sliding scale. By pulling both ends of the pencil, the upper piece slides along the lower one.

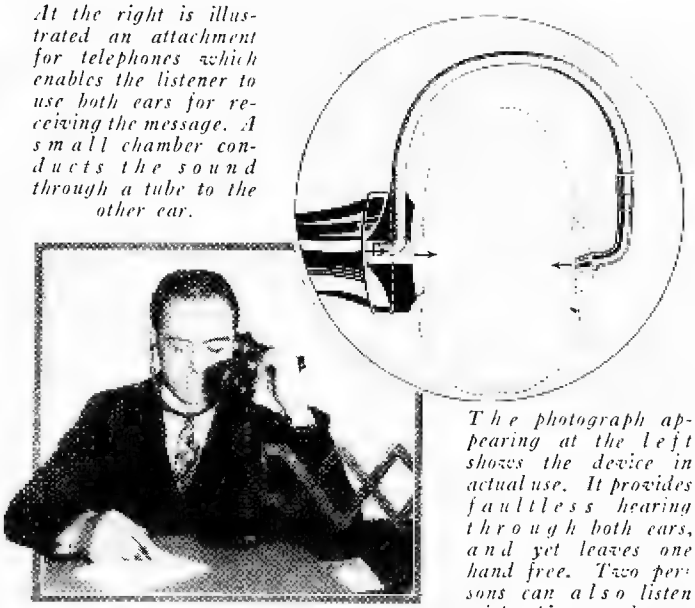
Automatic Awning



The above illustration shows an automatic electric awning, which is lowered by a photo-electric cell control, so that the blind rises when the sun goes down, or vice versa.

Twin Telephone Attachment

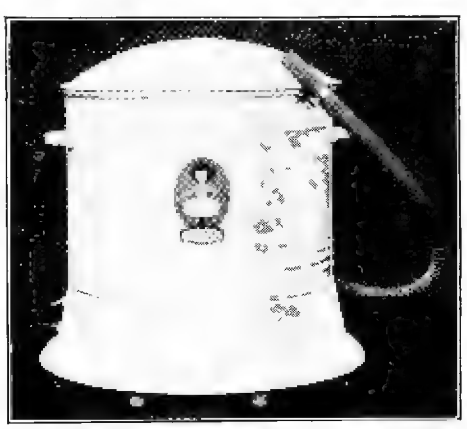
At the right is illustrated an attachment for telephones which enables the listener to use both ears for receiving the message. A small chamber conducts the sound through a tube to the other ear.

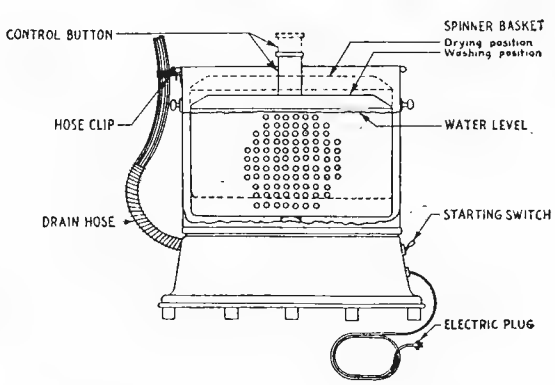


The photograph appearing at the left shows the device in actual use. It provides faultless hearing through both ears, and yet leaves one hand free. Two persons can also listen with this attachment.

Washer and Drier

At the right is a photograph of the small combination washing machine and clothes drier. The hose visible at the front is used for the drain. The drawing below is a sectional view of the device, with all features indicated. When in a drying position, the clothes container is raised.





A COMBINATION clothes drier and washing machine has recently appeared on the market. It is small in size, so that it can be accommodated in the modern apartment and placed in a closet when not in use. The basket, when clothes are to be washed, is driven by change gears, which impart a reciprocating motion to the clothes container, driving it at relatively low speed. When the basket is to be used as a centrifugal drier, a button is pressed which raises it, changing the gears which then rotate it at high speed in one direction only.

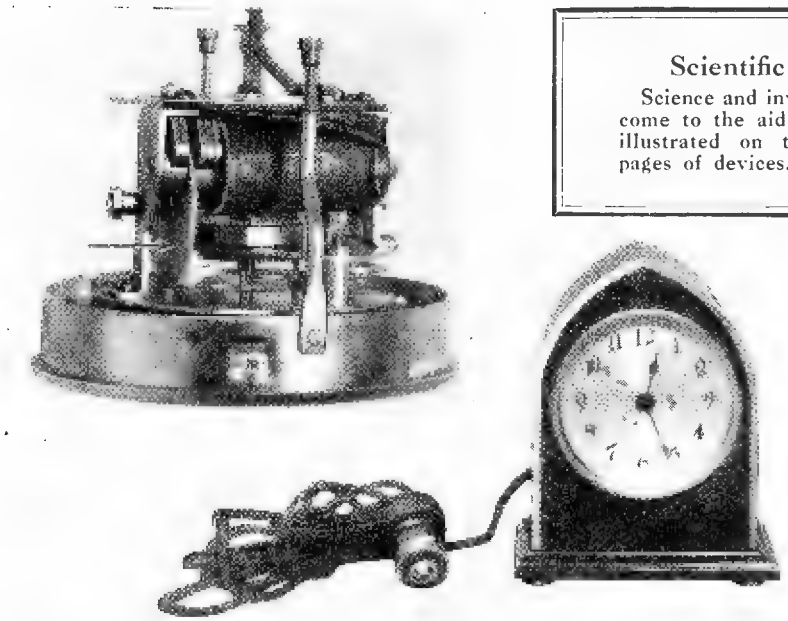
New Accessories for Home and Business

On this and the opposite page are illustrated and described some of the latest devices to be made available for home and office use. These are time and labor saving appliances which will lighten everyday tasks and enable them to be performed more quickly. While there are many new devices, it is necessary to devote this space to those of special interest only.

Names of manufacturers supplied upon request.

TIME SAVERS

Electric Clock

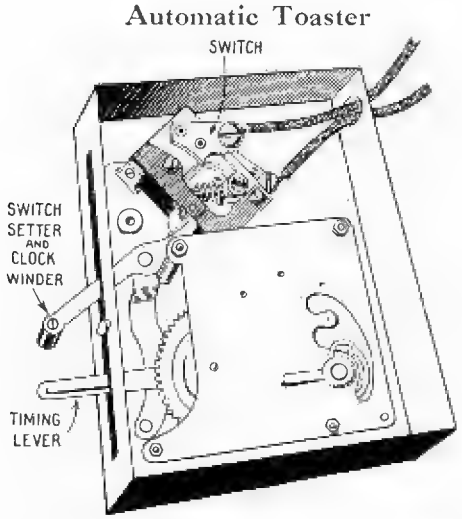


Scientific Aids

Science and invention have come to the aid of man, as illustrated on these two pages of devices.

Illustrated above is an electric clock for the home or office, which is run by a small induction motor drawing its supply from the alternating current light lines. The arrow in the interior view points to the disc in the motor. Correct time always is assured by this clock.

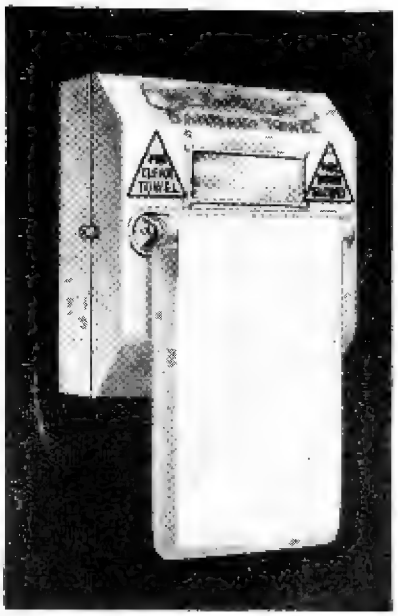
Automatic Toaster



AN electric toaster, which is shut off automatically when the bread is browned, helps to make the matutinal repast a pleasant meal. A small timing lever enables one to toast the bread to any desired degree of brownness. A switch setter operated by a clock mechanism cuts off the voltage supply when the bread is finished.

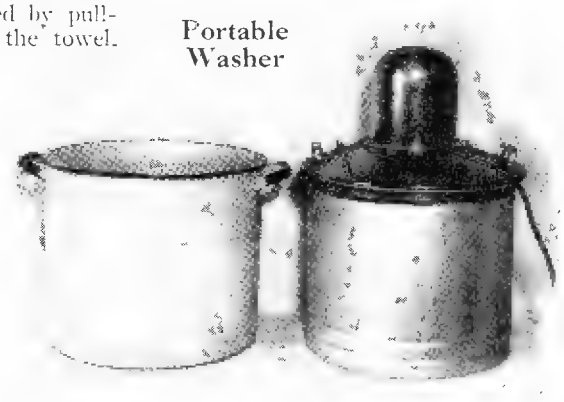
Above is a drawing of the timing mechanism. The lever at the bottom is set to a predetermined time and the switch setter is pulled to the end of the slot. This lever also winds a small clock mechanism and moves, as the clock goes, from one end of the slot to the other until the time setting is reached, when the voltage supply is turned off automatically. The photograph shows the toaster just after the time mechanism has operated.

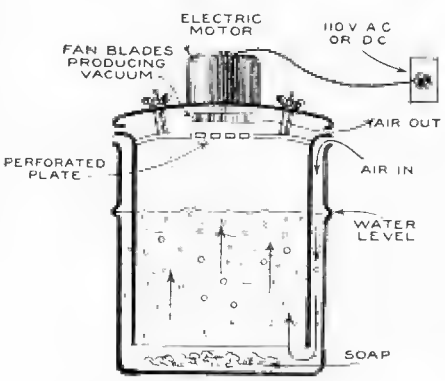
FOR office and public use, a roller towel container has been developed which automatically winds up the soiled portion as a fresh surface is exposed by pulling the towel.



The above photograph shows the continuous roller towel, a clean portion of which is always available for the user.

Portable Washer

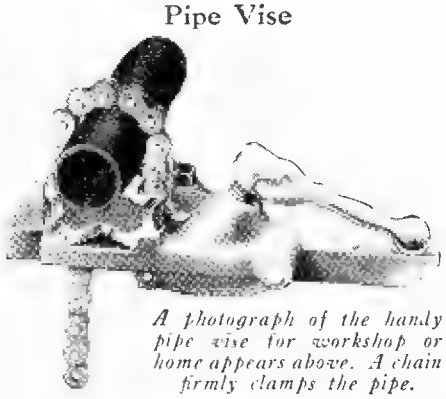




A small portable pneumatic washing machine is shown in the above photograph. The illustration at the left shows the operating principle. An electric motor at the top drives a fan, which produces a partial vacuum, pulling the air in from the sides to the bottom and up through the water. The arrows show the pathway of the air.

OF interest to the mechanic is a pipe vise, which employs a chain for holding the object. The adjusting handle is situated on the top, where it is readily accessible. When a pipe or rod is gripped with sufficient tension, it cannot turn.

Pipe Vise



A photograph of the handy pipe vise for workshop or home appears above. A chain firmly clamps the pipe.

How Our Forefathers Lit Their Pipes and Cigars

Forerunners of Pocket Lighters

Interesting Photographs of the Predecessors of this Modern Pocket Cigar and Cigarette Lighter Age

Fig. 1. An elaborate home-lighting fixture, graced by a symbolical figure of the sun. It was made of silver.

Evolution of Lighters

EVEN in the days of our forefathers some system was developed periodically for making it easier to light the tobacco in pipes or cigars. The illustrations on this page show some of the earlier attempts.

THE photographs on this page are numbered so the reader will not find it difficult to compare the text with the illustrations. They illustrate a few of the countless lighting fixtures which were in use in ancient days. Incidentally, they are by no means the earliest, dating back only to the eighteenth century. Fig. 1 shows an elaborate home-lighting fixture used in these ancient days. The coiled tube was made of silver and mounted on a triangular pedestal, also made of silver. The wick was inserted in the tube containing the oil, and an attractive symbol of the sun's rays enhanced the beauty of this fixture, when it was not being used for illumination, and partially served as a reflector when so used. Most devices of this type were provided with some means of extinguishing the flame by either pinching it out, or covering it to smother the fire.

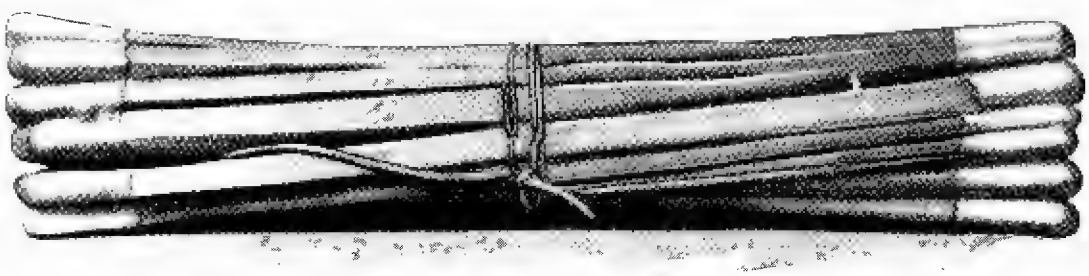


Fig. 2. A bundle of early matches. These were made entirely by hand, and were supplied in the wrappings illustrated. The matches were fully four times as large as our present day brand.

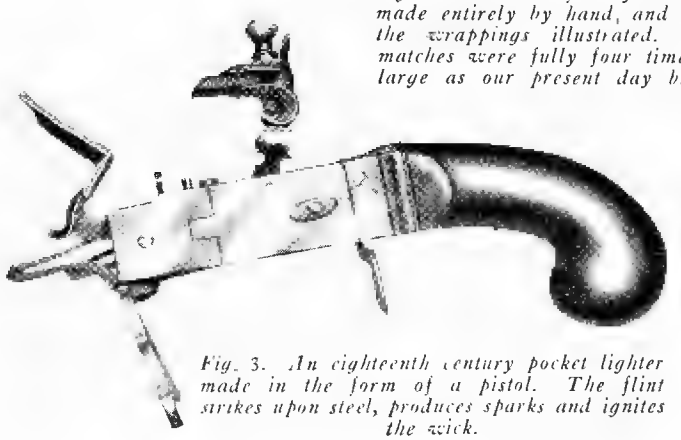


Fig. 3. An eighteenth century pocket lighter made in the form of a pistol. The flint strikes upon steel, produces sparks and ignites the wick.

Fig. 4. Another pocket lighter containing wick, flint, and steel in box. Was hung from the belt.

FIG. 2 shows a forerunner of the present day match. This interesting fire lighter, and incidentally, cigar lighter, revolutionized human life. The wood was split by hand, and the matches were hand-dipped. They were then bound in bundles as the photograph shows, and each bundle contained approximately 25 matches. Imagine a bundle of 100 matches tied up in this fashion.

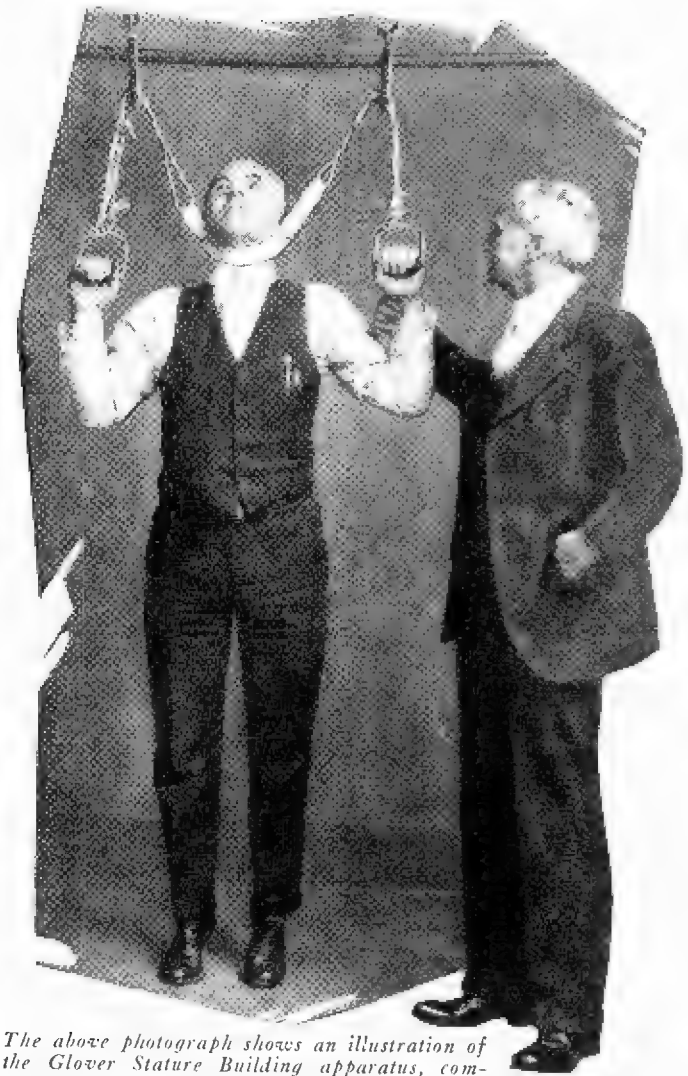
Fig. 3 shows the forerunner of the pocket lighter. This interesting fire and cigar lighter looks somewhat like an old pistol. Undoubtedly flintlock pistols suggested this lighter. As can be seen, a piece of flint is held between two steel tongues. It is released when the trigger is pulled, and strikes a hard steel blade on the opposite side, causing sparks to fly and light the wick.

Fig. 5. An early eighteenth century, elaborately carved metal candle holder. Splints in holder were used for lighting fires or pipes.

IN the eighteenth century, a pocket lighter was introduced like the one in Fig. 4. This consisted of a steel box in which was a wool wick, a blade of steel, and a piece of flint. The entire article was hung by a belt on the side of the trousers. When it was to be used, the steel was struck with the flint, and the sparks falling on the wick would cause it to glow. The wick was then fanned into brightness, and used for lighting fires or pipes. Fig. 5 shows an attractive and quite elaborately carved metal candleholder, which served in many homes of the early eighteenth century. Note the tapers for carrying a flame to different parts of the house.

New Advances in Medicine

Part of Eye Transplanted, the Deadly Pocket Handkerchief, the Safety of Artificial Coloring, and the Fraudulent Body Stretcher



The above photograph shows an illustration of the Glover Stature Building apparatus, commented upon in the previous issue of this publication in the Readers' Forum Department. Its use is being demonstrated by two governmental employees.

This mechanism was a body-stretching apparatus, differing but in respect to its simplicity from devices such as the rack used during medieval days of torture.

The illustration on this page shows the Glover apparatus being demonstrated by two governmental employees.

Postal inspectors arrested the sponsors of the apparatus on charges of using the mails to defraud. As can be seen in the photograph, the device consists of ropes and handles, with a strap to go under the chin and around the back of the neck. The person was supposed to lift himself up by these handles and thus allow the body to stretch. Evidently the inventor received little benefit from this device, because he himself was a very short man.

It has been demonstrated that artificial coloring and flavoring is absolutely safe.

Portion of Eye Successfully Transplanted

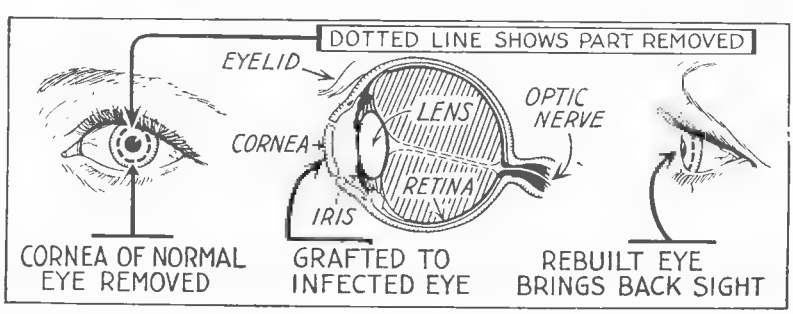
RECENTLY, at the New York Eye and Ear Clinic, an injured cornea which had become opaque and admitted no light was removed from the human eye, and the cornea from a normal eye was transplanted thereto. The result was that the patient regained sight in his fast failing eye. While he could not see as well as though this eye were normal, he could see objects as much as ten feet away. The operation was performed by Dr. Ben Witt Key. As will be observed from the diagram, the outside coat of the eye-ball, that is, the white of the eye, is tough and opaque, but in the front part of the eye the sclera becomes transparent. At this point the white portion or sclera is called the cornea. If the cornea becomes fogged, the eye is useless.

It has been experimentally demonstrated that the eyes of fish can be transplanted in their entirety. In the human being the operation here described is the nearest approach to complete transplantation. (*Continued on page 273*)

IN the last issue of SCIENCE AND INVENTION magazine, in the Readers' Forum Department, we found a reproduction of the advertisement used by the Glover Institute of Chicago, Ill., for a device which *increased the height of the individual using the same in a few months, improved health, gave more pep, life, greater efficiency and joy in living.* And this was supposedly *based on sound scientific principles.*

The pocket handkerchief is an ideal place for the breeding of germs.

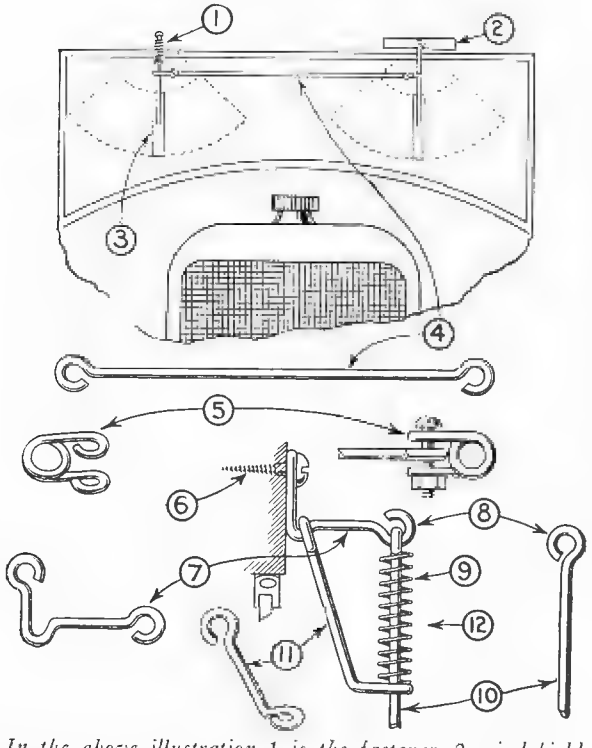
Many believe that placing the handkerchief over the mouthpiece of the telephone prevents germ infection. There is no truth to this belief. Right: How a portion of the cornea of the human eye was recently successfully transplanted.



Motor Hints

Conducted by GEORGE A. LUERS

Double Windshield Wiper



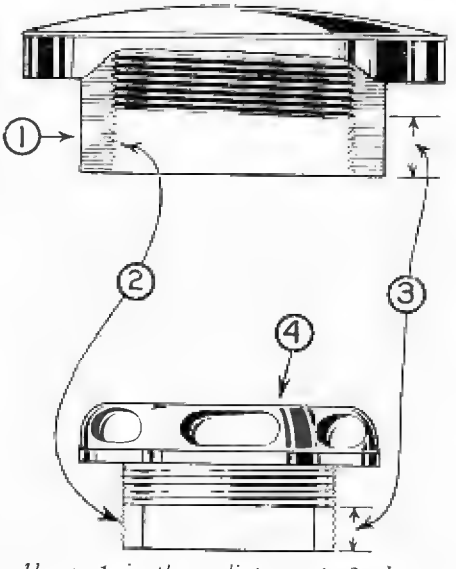
In the above illustration 1 is the fastener, 2 windshield wiper, 3 extra blade, 4 cross-arm, 5 end connection, 6 screw, 7 holder, 8 eye, 9 spring, 10 swipe arm, 11 connection.

A MEANS for adding a wiper to the windshield cleaner is shown above. The method uses a simple connecting rod and wire hanger, which operates the extra blade. The cross-arm is made from steel wire and the ends of this are attached to the swipe arms, using small pieces of wire to form joint clamps and swivels. The fastener consists mainly of two pieces of wire, bent as illustrated with hooked ends. A small brass spring provides pressure and compresses when the windshield is opened.

Do You Know—

a new flat radiator cap and side lamps with saddle band are conspicuous factors in modernizing a previous model of car. With these inexpensive additions the owner may be content to drive the car another year, and also these increase the trade-in value.

Changing Threads Saves Time

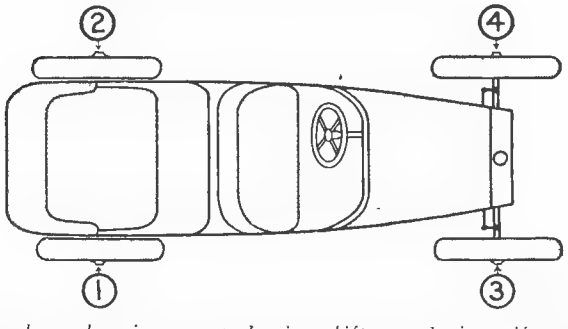


Above—1 is the radiator cap, 2 shows original thread, 3 threads removed, 4 gasoline tank cap.

A MEANS to save time for the car owner where parts of the car are threaded together is shown by the above illustration of a gas tank cap and radiator filler cap. These parts are altered to the extent of diminishing the number of existing threads to less than half the original. The change can be effected by grinding off the surplus threads, leaving more than ample for holding the parts. Obviously less than half the time previously taken will be required to remove or replace either of these caps. There are other car parts which can advantageously be treated in the same manner. Such parts are the spare tire-holder bolts, the differential filler and drain plugs, crankcase drain plug, and plugs in the gasoline drain line.

One manufacturer recently adopted a thread length for his spark plugs nearly one-half of that previously used. Shortening the threads, in many cases, can be done by the car owner with a grinding wheel at home.

Securing Uniform Tire Wear

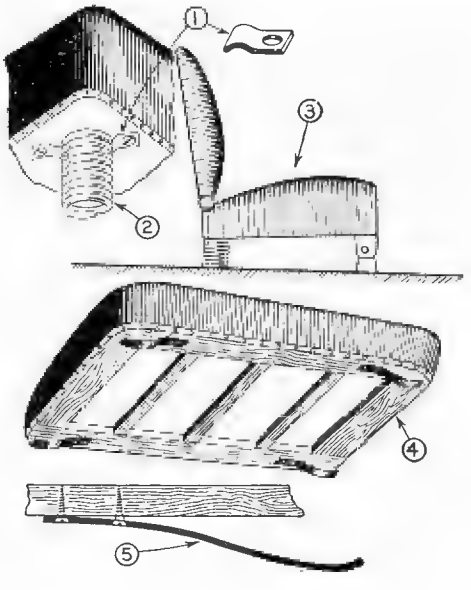


In the above drawing quarterly tire shifts to obtain uniform wear are shown. The right rear tire is shifted to wheel 4, the left rear to wheel 3, the right front to wheel 2, and the left front tire is changed to wheel 1.

INVARIABLY the wearing of tires occurs as follows: right rear, left rear, right front, and then left front. This is caused by the slope of the road and due to the fact that the rear wheels carry more weight. The right front wheel carries the most weight of the front tires and the right rear wheel wears first. To secure uniform wear, the tires should be changed every three months to the positions indicated.

Seat Springs

THE riding qualities of folding coach seats can be improved by using four discarded valve springs. Box type seats can be fitted with four flat leaf-like springs under each edge. These alterations are depicted in the accompanying illustration and can be readily adopted by any automobile owner.

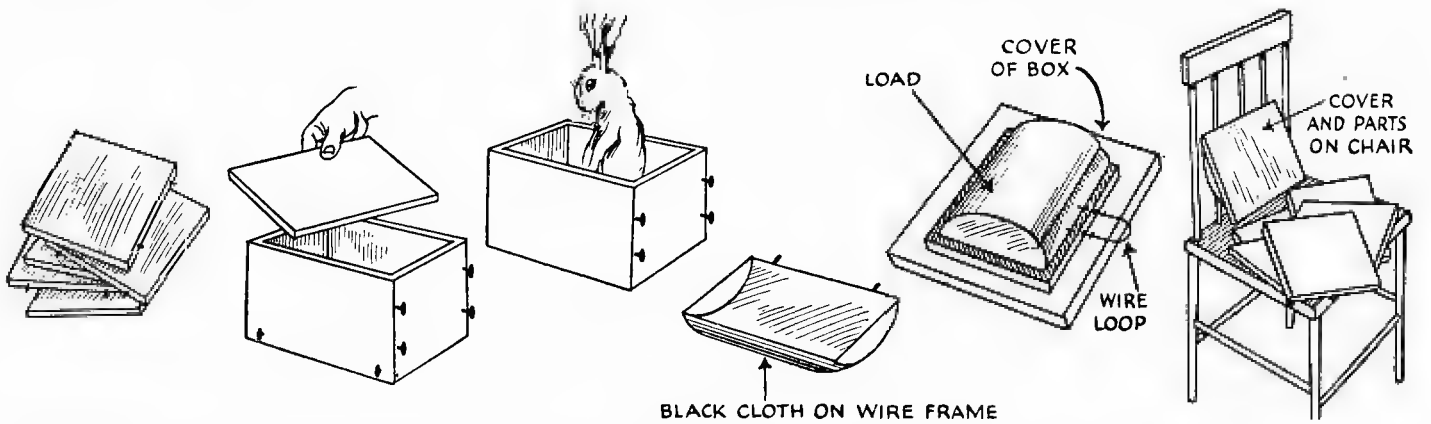


In the illustration at the right 1 are clips, 2 valve springs, 3 coach seat, 4 box seat, 5 flat spring.

MAGIC by DUNNINGER

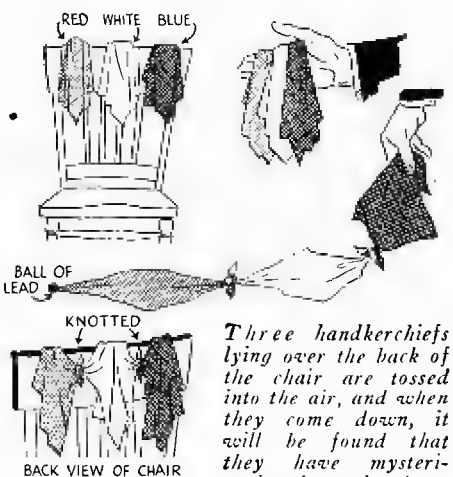
NUMBER 71 OF A SERIES

Interesting Tricks for Amateur Parlor, Lyceum and Professional Entertainer



Black box mystery: This trick which the writer invented some years ago has been used by many prominent magicians. As can be observed by the drawings above, it consists of a box made up of six pieces, all held in place by screws. The box is originally shown on the chair. It is assembled, then a shot it fired at it, and on being opened, it is found to contain a rabbit. As will be observed, the rabbit is concealed in a black cloth bag, attached to the portion of the box which makes the cover. This is positioned on a chair in such a way that the load cannot be seen. The wire loop, when withdrawn, drops the load into the bottom of the assembled box.

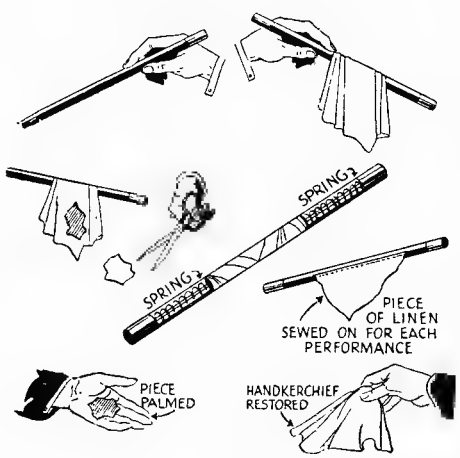
Handkerchief Restoration



Three handkerchiefs lying over the back of the chair are tossed into the air, and when they come down, it will be found that they have mysteriously knotted themselves together. Actually, they are knotted before being thrown, the knots being concealed by the chair top.

IN this effect, three handkerchiefs of different colors are seen lying over the back of the chair as illustrated. The wizard gathers these up in the palm of his hand, and directs attention to the simplicity of the movement. Tossing the silks into the air, he causes them to knot themselves as they descend. The Secret: The handkerchiefs are actually knotted, but the knots are concealed from view by the manner in which the silks are hung across the flat back of the chair. A small ball of lead sewed into one corner of the end handkerchief gives the effect of knotting in mid-air, and adds an interesting flourish.

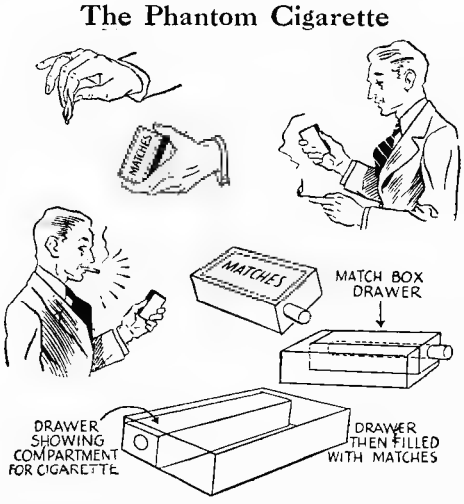
Mysterious Knots



By aid of the mechanical wand here illustrated, it is possible to cut a piece out of a handkerchief and restore the kerchief again.

THE wizard borrows a handkerchief which he places over a wand to prove that it is not exchanged. He then takes his shears and deliberately cuts off a piece of the handkerchief while it still hangs from the wand. He removes the kerchief, rubs it and the piece cut off together and restores it to its original condition. The Secret: The wand is mechanical, and consists of a thin piece of metal tubing, on the inside of which is a rod operated by two springs. To this rod is attached a piece of white linen which can be pulled in or out through a slit in the wand itself. It is this that the wonder-worker cuts; in the act of restoring the handkerchief, the piece is palmed.

The Phantom Cigarette



With the aid of the match-box having a separate compartment in the drawer a match can apparently be converted into a cigarette.

IN the phantom cigarette trick, we find another of the pocket group of tricks which is entirely new, and mystifying. The wizard opens his cigarette case and discovers it empty. His friends naturally come to his rescue, but being of a particular nature, he prefers his own brand. Reaching into his pocket, he removes a match box, and pushing it out so that all can see its contents, he strikes one of the matches and holds it up to his face as though he were lighting a cigarette. Much to the bewilderment of the onlookers, a cigarette mysteriously appears between the lips of the conjurer which he proceeds to smoke with great delight. The Secret: The match-box itself is far from ordinary, although at first it may appear to be the common variety. The illustration shows that a secret drawer has been built into one side of the ordinary sliding compartment, which contains the cigarette. A number of matches have then been placed over this smaller compartment, and they may be glued in place, if this procedure is thought desirable. The other matches in the drawer are loose. In the act of raising the hands to the mouth, one naturally carries the cigarette box with him. In cupping the hands, apparently to prevent the flame from being blown out, the performer will find it an easy matter to extract the cigarette from the compartment by gripping it between the lips. With a little practice, this move can be well executed.

HOME MOVIES

How to Perform Outdoor Tricks with the Interesting Shots and Scenes for the

First Position Of Airplane.
Second Position.
Line Of Vision Of Camera At Start.
Line Of Vision Of Camera At Finish.
A TRICK AIRPLANE SHOT. TRY IT!
Effect Gained By Pointing Camera Up A Bridge Tower Or Tall Building.
People, Horses, Autos And Street Cars Look Odd From The Twentieth Story Of A Building.
Did You Know Your Car Looked Like This?
Put Your Camera Near The Wheel And See!

ROCKLAND'S movie amateurs had decided to hold a contest on "trick" shots and scenes. Some were using the mask box, which had been described to them by the expert, Mr. Jones. (*See* SCIENCE AND INVENTION, *May*, 1929). Others were using devices of their own design, but the majority were using their regular camera equipment with no additions of any kind, just applying a little careful thought and planning.

The mask-box demon had taken literally hundreds of feet of street scenes in which cars and people vanished into thin air as they crossed a certain point in the line of vision. He also had two pictures of the same street on the frame at once, one above the other, sometimes with the uppermost upside down (Fig. 1). To do this, he simply put on his mask box, used a vertical slide, took one scene, being careful that the slide did not cut off the top of any buildings, the scene ending in clear sky. Then he reversed the position of the slide so that it cut off the bottom of the film aperture, rewound the film to his starting point and made his second exposure upside *down* (Figs. 1 and 2 at top, left).

When Cellar Meets Cellar

NEXT he took a picture of the tallest building in town, a building that towered above the buildings around it and masked off the *bottom*. Rewinding the film, reversing the mask, turning the camera upside down again, he carefully matched the two exposures (by comparison with marks previously made on a micro-focuser) and exposed the second time. On the screen the effect was that the building was supported by nothingness in mid-air with a symmetrical tower on top and bottom (Fig. 2). He made similar shots of lower parts of buildings, cutting off at the sidewalk line and having the upside-down part at the bottom of the frame. These were all assembled under the title "Mirages."

"Speed" Not Always What It Seems

ANOTHER member of the club was busy with his ideas of the "German technique" (Figs. 3, 4, 5), once so popular in Hollywood and all based on the theory that a motion-picture camera should record motion, and therefore why not *move the camera itself?* He fastened his camera to the running board of his car, tilting it slightly upwards and securing a distorted and most effective perspective as he threaded through traffic. He secured a single exposure attachment and, fastening the camera to the front of his car, made *stop-motion* films by pulling a string and releasing his shutter about two times a second instead of the normal sixteen. The effect was that of a car moving about eighty miles an hour through heavy traffic, stopping "on a dime," starting smoothly at forty miles an hour and having many narrow escapes from collision. The picture was actually made at a speed of fifteen or twenty miles an hour.

The photograph below shows Charles Ray and Sally O'Neill with a camera placed on the front of the car for taking close-up shots of the driver while the automobile is running. The camera can also be mounted in the rear of the car and many novel scenes thus procured (Fig. 6).

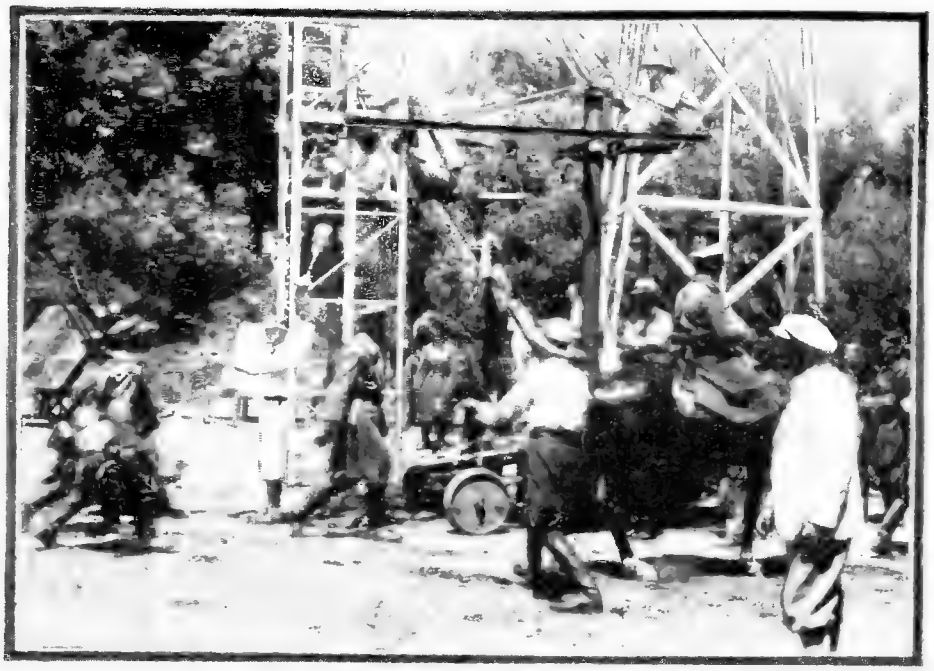
Photo courtesy Metro-Goldwyn-Mayer

Conducted by
DON BENNETT

Camera and Obtain Amateur Picture

Trick Automobile Shots

HE removed the windshield of his car and fastened the camera on the radiator spout, pointing directly at himself, and then acted as if he were half asleep (Fig. 6). These sequences, cut into the rapid action at several places, only increased the thrill on the part of the audience. He borrowed a slow-motion camera from a friend, fastened it to a board, on which he also placed his camera and another regular camera set at half speed, and attached control strings to all three. A third camera had a stop-motion attachment on it to provide for the exposure of single frames. He used this first and exposed about ten feet in this manner, and when he had almost finished the stop-motion, he started the camera set for regular speed, so that the two would overlap for a few seconds, and then stopped using the stop-motion camera. When he had about ten feet of film exposed by the regular camera, he started the slow-motion camera. He let the two cameras overlap and, after about thirty or forty feet of slow motion, he stopped that camera too. The cameras had all been mounted on his car, and the car was moving rapidly along the street. When his film was finished, he cut out the overlapping frames, put in a title "Motion plus!" and projected a picture of a rapidly moving city, which soon became normal and then so slow that everyone seemed asleep.



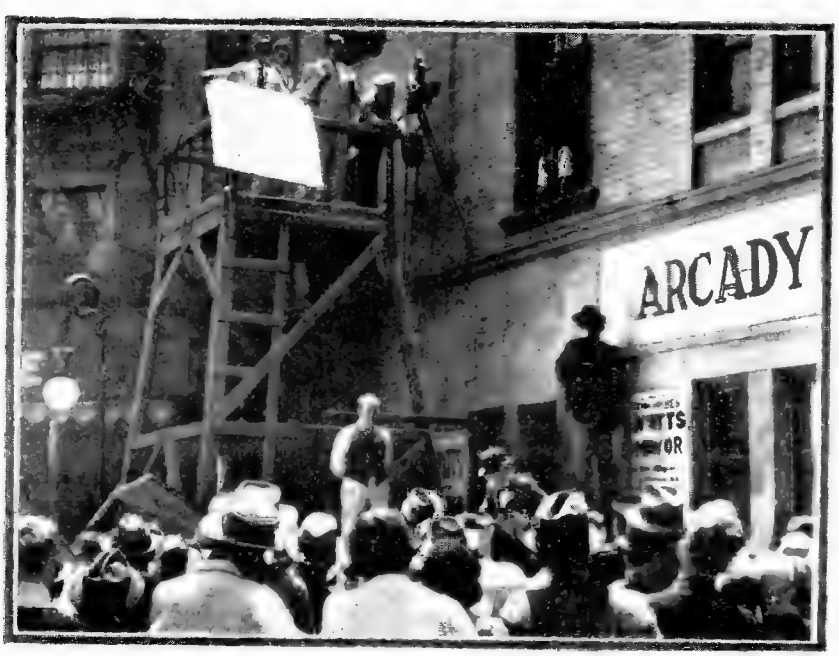
A camera crane is shown in the above photograph. This structure allows pictures to be taken from any angle. The camera slides up and down in the shaft and the entire contrivance revolves about a cylindrical pivot on the car (Fig. 3).

Fig. 4—At the right is a "still" of Lon Chaney. The camera is moved about on a truck.

Photo courtesy Metro-Goldwyn-Mayer

Fig. 5—The photograph below shows a camera arranged for a "high angle-shot."

Photo courtesy First National



Boat Speeds Down a Street

THIS same amateur took his camera out in a speedboat, set up his tripod just back of the helmsman and shot rapid turns, skids, and sudden stops in a most interesting way. Then he mounted a bridge, had the speedboat come towards him at its fastest rate of speed and slightly under-exposed the shot, masking off the edges about one-third of the way in on each side. This piece he had developed as a negative. On the same roll, he exposed a scene exactly down the center of the main street from about the same height as the bridge was above the water. This was also developed as a negative. The two pieces were laid together when making the print, and the effect was that the boat came rushing down the street, disregarding the cars and pedestrian traffic.

One amateur used a dissolving device that enabled him to fade in and out at a predetermined rate of speed, so that all his dissolves would be equal. He boarded a street car and set his camera up on the back platform, mounted on the tripod. He faded in on a shot to the left, ran three feet and faded out. He then swung his camera until it pointed in the opposite direction and faded in and out on the other (*Continued on page 277*)

CHEMISTRY *and* ELECTRICS

A number of turns of wire wrapped around an iron core and connected to a pair of headphones and placed near the transformer will enable one to hear the hum caused when the iron becomes alternately magnetized and demagnetized.

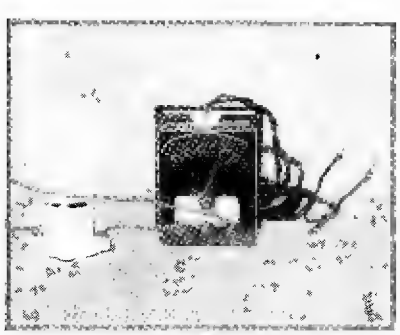
Toy Transformer Experiments

By RAYMOND B. WAILES

A Nail, a Flashlight Lamp, Some Wire and a Small Transformer Provide the Necessary Apparatus for Conducting a Number of Simple Yet Interesting Experiments Which Are Amusing as Well as Instructive

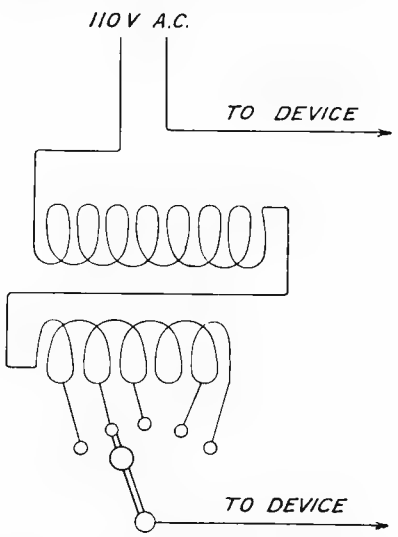
MANY instructive experiments can be performed with a toy transformer, some wire, a nail and a flashlight lamp. Perhaps the simplest transformer which exists can be made from the latter three items. Winding a hundred feet of "medium-sized" wire (about No. 18) around a nail and then winding about fifty feet of a smaller wire upon this forms an experimental transformer in its simplest form. The first length of wire is termed the primary and is usually of heavier wire than the second layer of finer wire, which is called the secondary winding. But simple as the little transformer described is, it will readily light a small flashlight lamp by using the 110-volt house lighting *alternating current*. The connections are shown in the photograph. The test clips are connected to the heavier wire, or primary. One of the clips is connected to one wire of the house current; the other clip is connected with a 100-watt lamp, while the other terminal of the lamp is connected to the remaining side of the house circuit. If the flashlight lamp does not light, use more wire in the primary and also try a larger size lamp than the 100 watt.

Toy transformers have an iron core upon which is wound the primary and secondary windings, the latter being



The above photograph shows a step-down transformer used to boost the voltage, which can often be raised from 110 volts to as high as 200 volts.

How The Connections Are Made To Boost The Line Voltage.



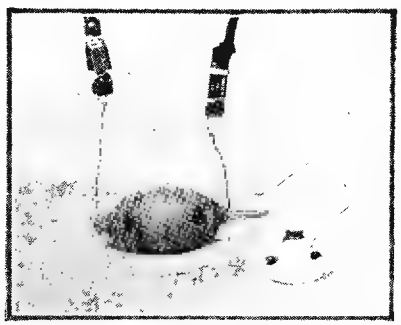
The line voltage may be raised by connecting the primary and secondary of the toy transformer in series.

made into sections, or tapped so that various numbers of turns of wire can be incorporated into the secondary circuit. Toy transformers have a greater number of turns of wire on the primary than on the secondary. This results in a "step down" transformer, for the voltage on the output or secondary side is lower than the input or primary side, which is about 110 volts.

Step-Up Transformer

BY applying 110 volts, using a lamp in series, to the secondary winding of the transformer, the secondary can be made to act as the primary of a step-up transformer and actually boost the voltage up. A photograph shows the connections for this experiment. As much as 200 volts can be obtained in this manner. It is best to not allow the current to pass through a transformer of the toy type if it becomes unreasonably hot to the touch or begins to smoke or emit vapors of heated insulating material.

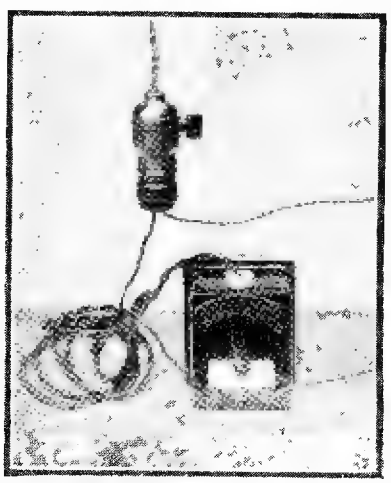
In some instances where a voltage higher than that of the house lighting system is desired, for instance in places where, due to heavy loads, the line voltage is below that required, a toy transformer can be made to boost up and deliver the required voltage by placing the primary and the secondary in series with each other. Such a connection is shown illustrated. If the desired voltage is not secured in this manner, the primary or the secondary coil should be connected opposite to the manner in which it is operating. The writer has used this scheme of connections when the line voltage was below 100 volts, boosting the voltage up to 110.



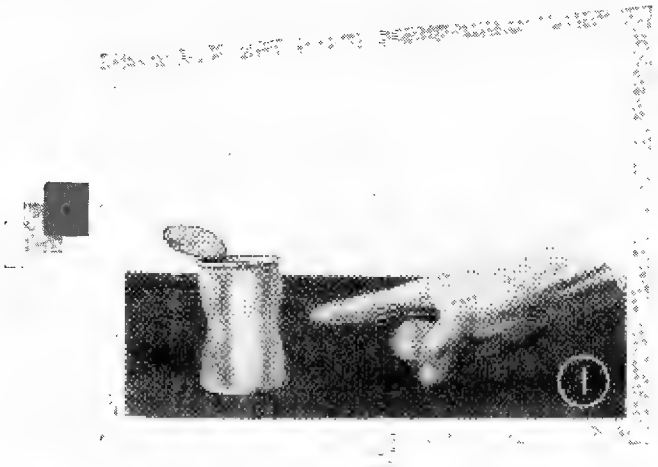
Perhaps the simplest transformer consists of about 100 ft. of No. 18 wire wound around a nail with 50 ft. of smaller size wire wound on top of the larger wire which forms the primary. A small flashlight lamp can be lit from the secondary.

"Exploring Coil"

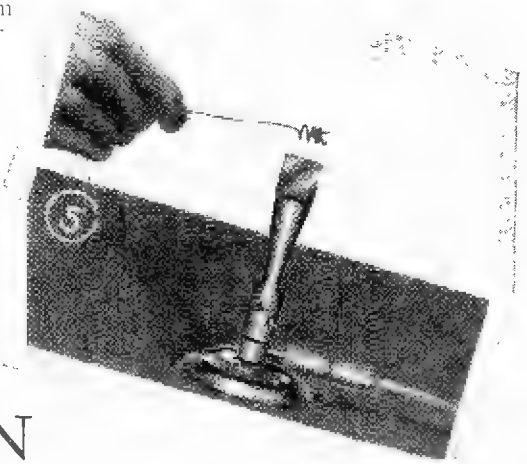
A LITTLE experiment with a transformer can be performed with the aid of an "exploring coil," which here consists of nothing more than an iron core wrapped with a hundred or more turns of wire which is connected with a pair of radio receivers. The iron core, held near a toy transformer in operating will become alternately magnetized and demagnetized, due to the collapse and fall of the magnetic lines of force in the core of the toy transformer, and will produce a current which in turn will actuate the receivers, causing a humming sound. This exploring coil, as it could be called, can also be used about other electrical devices when they are in operation, for instance, an electric fan, or an A or B charging device.



The photograph above shows the transformer with primary and secondary wired in series. Where the line voltage is below 100 volts, the output voltage will often be 110 volts.



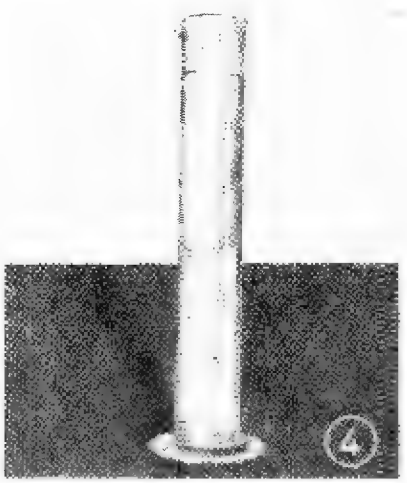
1. Adsorption is different from absorption, an example of the latter being the blotting of ink by "blotters." Here the ink penetrates into the pores. If the ink only was sucked up upon the *surface* of the blotter, the phenomenon would approach adsorption. A can of glue if left to harden will be found to have its sides pulled in, so great is the effect of the glue which is adsorbed upon the interior of the can.



ADSORPTION

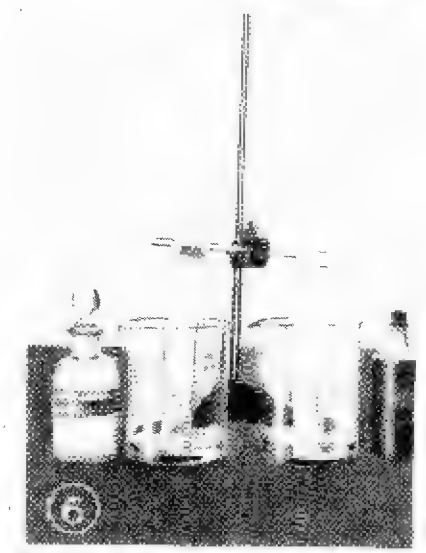
By Raymond B. Wailes

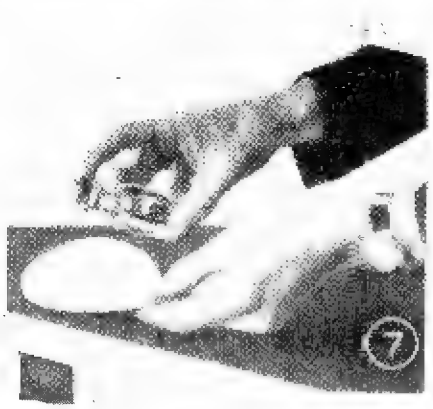
Adsorption and Absorption Often Confused. Simple Tests for Former Quality

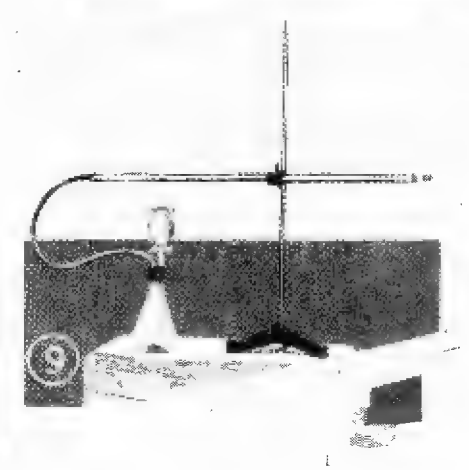


2. A little experiment in adsorption can be performed by immersing the hand in water and withdrawing it—dry. Sprinkle the surface of the water first, with lycopodium powder, then immerse the hands. The water is adsorbed upon the lycopodium powder which covers the hands and consequently does not break through and wet the hands. It is like having on a glove of powder which will not allow the water to seep through.

3. Fuller's earth is used for removing spots on clothing. The process is adsorption. Two flasks or bottles containing a dye are (*Continued on page 271*)







Prizes for Glider Duration Flights

Motorless Plane Owners Can Compete for Cash Awards and Trophy

Miss Amelia Earhart and Mr. Edward S. Evans are shown below discussing the prizes offered for duration flights in gliders. The trophy award is visible in the background.

THE National Glider Association, Inc., an organization engaged in the promotion of motorless plane flying in the United States, has announced a duration flight contest for glider pilots, with a beautiful trophy and cash awards offered.

The National Glider Association, Inc., enjoys the backing of the National Aeronautical Association, which has approved the steps taken by the N. G. A. for the licensing of third and second-class glider pilots and has authorized the licensing of first-class pilots in the name of the N. A. A., but under the auspices of the N. G. A.

Cash Prizes Offered

MR. EVANS, the president of the N. G. A., offers purses in cash, totaling $3,000, for duration flights in motorless airplanes.

For the first ten-hour flight under official observation to be made by an American citizen $2,000 is offered.

Additional prizes of $100 per hour for each hour in excess of ten hours up to a total of twenty hours will be paid by Mr. Evans, making the total of $3,000 available for a twenty-hour flight.

The rules for eligibility and the conditions under which the trials are to be made are given in the following paragraphs and must be strictly observed.

Rules

UNDER the rules of the N. G. A., soaring flight records such as would be necessary to win the prize can only be attempted by pilots holding a first-class glider pilot's license of the National Aeronautical Association. Under F. A. I. (Federation Aeronautique Internationale) and N. A. A., such pilots can only compete in sanctioned events. This prize has been sanctioned by the N. A. A. under rules of the F. A. I. and under its rules.

The prize will stand only until the record of ten hours or better shall have been officially established for the first time under the rules of the N. A. A.

Division of Money

THE prize money will be divided equally between the pilot and the owner or owners of the glider which establishes such a record. If the pilot owns the glider, he will receive all of the prize money earned.

Trophy

IN addition to the prize money, Mr. Evans also offers a handsome trophy, which has been prepared under his personal direction. It will be awarded each year to the club, other approved organization or individual member of the N. G. A. represented by the winner in the Annual National Contest. The winning club, organization or individual member is entitled to possession of the trophy until the next contest. Any club, organization or individual member winning the trophy three years in succession becomes permanent owner of the trophy. Detailed rules for the National Contest will be announced by the National Contest Committee.

Clubs, organizations or individuals desiring to offer local, council or district trophies similar to but smaller than the national trophy can secure the same from the national headquarters at actual cost.

Motored Pilots Eligible

MOTORED pilots holding N. A. A. Annual Sporting licenses are eligible for glider contests and individual record attempts even if not holding a glider license. In events not requiring the sanction of the N. A. A., motored pilots holding Dep't of Commerce licenses may compete.

Should AMATEURS *Build* GLIDERS *from* BLUEPRINTS?

Affirmative Argument Set Forth

By Prof. Alexander Klemin

Professor of Aeronautical Engineering, Daniel Guggenheim School of Aeronautics, New York University

PROFESSOR Altman's article in a previous issue of SCIENCE AND INVENTION, advising the amateur not to build a glider from blueprints, contains many weighty arguments. Professor Altman is perfectly correct in stating that a badly built glider may offer serious dangers and that a glider has to be so light, that its structure is in some respects more refined than that of the powered airplane. He is perfectly right in many of his other objections. Yet, there is another side to the argument.

Too Much Done for Us in Modern Civilization

FAR too much is done for us in modern civilization. Instead of learning to play a musical instrument, we turn on the radio. Instead of cutting a tree down for fuel, we have a janitor who sends up heat when required. Even the automobile ceases to be an educational agent, because of its perfection and the ease with which service is obtained. Our boys lack the great advantages of pioneer life in which man's ingenuity and energy are fostered by daily contact with nature. In the glider we have a very valuable means of providing an equivalent in practical education.

Boys Interested in Making Things

THE great majority of boys and young men are interested in making things. It should not be forgotten that boys first started the popularity of the radio by constructing home-made sets which actually worked. Boys to-day build rubber band driven flying models which are splendid examples of ingenuity and accuracy of construction, and which fly extraordinary distances. The innumerable magazines and books devoted to telling boys how to make things are read by hundreds of thousands.

There is a tendency on the part of adults and particularly on the part of experts to under-rate the native ability of youth. An expert, according to William B. Stout, the aeronautical engineer, is a man who can find more reasons why a thing cannot be done than any one else can. Perhaps this somewhat unkind remark has a special application in the case of glider construction. The writer believes that the American youth has far more native ability in construction and far more application, provided the task is interesting and worth doing, than teachers and experts are apt to credit him with.

Glider not Difficult to Construct

A GLIDER is not particularly difficult to construct. Outside of control surfaces it has no moving parts, no finely meshing gears, no cylinders which must be ground absolutely true. A glider has to go together accurately, but the tolerances of each part need not be too close. The Germans, who have excelled in glider work in modern times, have produced several excellent texts on the construction and operation of gliders. Looking through the excellent manuals of Stamer and Lippisch, of Gymnich, and of Von Langsdorf, we find the simplest instruction for construction, and the parts illustrated offer no very great difficulties to the amateur mechanic. There is nothing extraordinary about the construction of a rib. Surely any amateur carpenter can take a piece of spruce and saw and plane it to reasonable accuracy. The use of glue and nails is not such a deep mystery.

Blue Prints Can Be Made Simple

WE defy any amateur to build from blueprints a high speed steam turbine or an alternating current generator. But every boy should learn to read blueprints, an art which in modern civilization is almost as necessary as the art of reading print. And every boy will learn almost without study to read the simple blueprints involved in glider construction. It is only necessary that the expert who prepares the blueprint should bear in mind the public for whom he is working, prepare his prints in the simplest possible form, supplement them with a pamphlet of instruction, mark up the prints themselves with legends which may not be necessary for the engineer, but will help the amateur extremely.

Materials Accessible

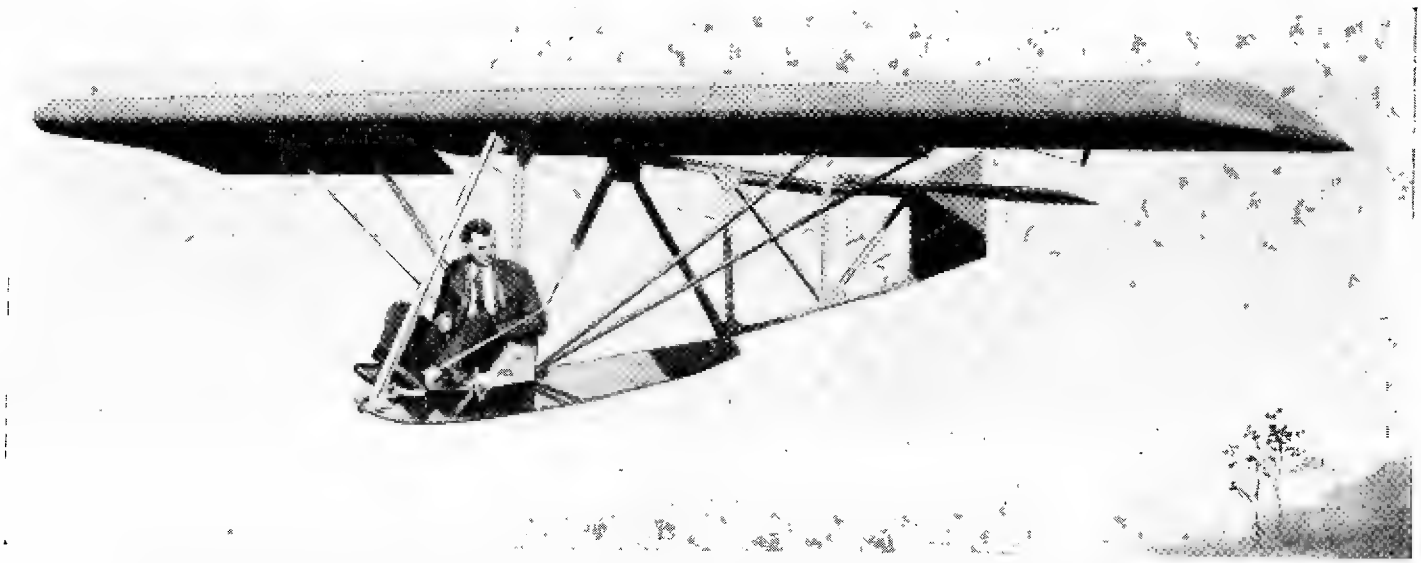
THE writer has had some practical experience with a group of students who started out to build a light plane. It is true that both their money and their enthusiasm ran out, which seems to be in full accord with one of Professor Altman's arguments. They attempted too ambitious a task, and wanted to employ too powerful an engine, but in obtaining their materials they got on remarkably well. They managed to secure their wood from a neighboring lumber yard without much difficulty. An airplane factory gave them all the veneer they wanted. In a large hardware store they got all the (iron and steel) materials they needed. This was several years ago before the airplane had reached its present popularity. It would now be still easier to secure the necessary materials. At almost every flying field there is now a supply and repair house from which the right material can be bought at reasonable prices. Every such supply house will be only too glad to assist an enthusiastic young group of glider builders.

Professor Altman in his article takes up the specific problem of fittings and the cold rolled steel required in such fittings. It is quite true that there are many varieties of cold rolled steel, and that specifications are hard to understand by non-technical men, but there is no reason why the blueprints should specify anything but mild commercial steel, which can be bought almost anywhere, and requires no special skill or knowledge for its purchase. In the light fittings required for the glider, there is little advantage to be gained by using special steels. Professor Altman also points out the real difficulty that in a fitting requiring a 90 degree bend, there is (*Continued on page* 281)

Home-Built Gliders Are Safe!

IT is entirely possible for the uninitiated to construct a glider from blueprints, contends Prof. Klemin. Provided that all precautions are observed, amateur glider building should not be any harder than amateur glider operation. Those who build their own gliders will make better operators. They will become familiar with the materials and processes, and if anything goes wrong they will know how to make repairs properly. The home glider builder is more likely to persist in the sport than those who buy their machines.

Prof. Alexander Klemin



Above is a photograph of a primary glider in flight. The fuselage is enclosed in the secondary type.

How to Build a Man-Carrying Glider

Part II—Conclusion By MARVIN A. NORTHROP

ADDITIONAL detail drawings for the man-carrying glider, which was described at length in the June issue of this magazine, are presented here. Plans for the spar brace clamp, aileron sheave bracket, dismount clamp, rudder bar, front flying wire clamp, sheave bracket, seat bracket, rear flying wire clamp, spar bracket, launching hook, aileron lever, pilon clamp, control stick yoke, elevator sheave yoke, bearing blocks, bearing strap, control shaft and control stick will be found in the accompanying drawing. The cable control hook-up or diagram is also shown.

Fittings

ALL fittings should be made accurately, as shown, and of the material indicated. The carbon steel should be annealed before bending and tempered afterward. The bolts should be of carbon or high tension steel, threaded S.A.E. or U.S.F. 32-thread for 3/16 in. bolts. After tightening the nut in place, the bolt should be cut flush with the nut and *riveted* with four center punch indentations in thread circle to prevent loosening.

Control Cables

THE control cables should be seven-strand flexible wire cord, looped through fittings with thimble inserts. The loop should be bound with copper wire, sweated with solder and the loose end doubled back and bound.

The wire used should be piano wire, looped through the fitting, "safety" secured with the loose end doubled back. The pins for hinges and doubled links should be of carbon steel of the proper length and secured with aircraft safety pins or cotter pins. The turnbuckles should be of a standard type and of correct size to develop the full strength of the wire or cable. After tightening, they should be secured from turning with copper wire lacing.

Rigging

ALL units should be assembled properly and securely connected. Tighten guy wires, stays and braces, so that the wings and stabilizer will be straight, level and at right angles to the fuselage. The control wires should be adjusted, so that when all controls are in "neutral" the ailerons conform to the wing shape and the elevator center line conforms to the stabilizer center line.

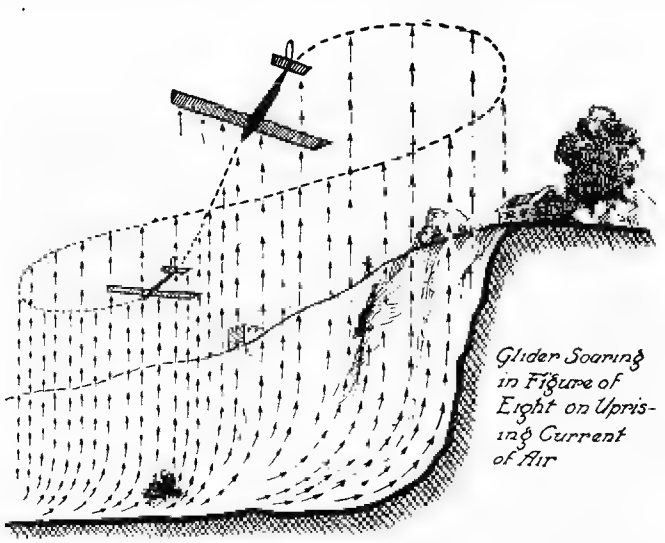
Mechanical Flight

ALL types of craft used for flying may be divided into two main classes; namely, passive and dynamic flying machines. The passive type can be further subdivided into two classes, the first of which includes all machines intended for gliding flight and the second those designed for soaring or moving through the air by the force of the wind without loss of altitude. Experiments with the two main classes are closely related, and the development of powered machines has depended to a great extent upon investigations and tests made with gliders and soaring devices.

Soaring and Gliding

THE glider described here is a primary glider and has an open fuselage. This is primarily suitable for training, although it may be used for soaring flight to a certain extent. The secondary glider has a closed fuselage and is of finer design, and the tertiary or soaring glider has an enclosed fuselage with a greater ratio of length to wing span. For soaring flight, the pilot must take advantage of the uprising air currents and should have a good practical knowledge of air currents and weather conditions that influence them in order to sustain the flight for any length of time. For soaring, a cliff or long ridge is used for launching the ship. See illustration.

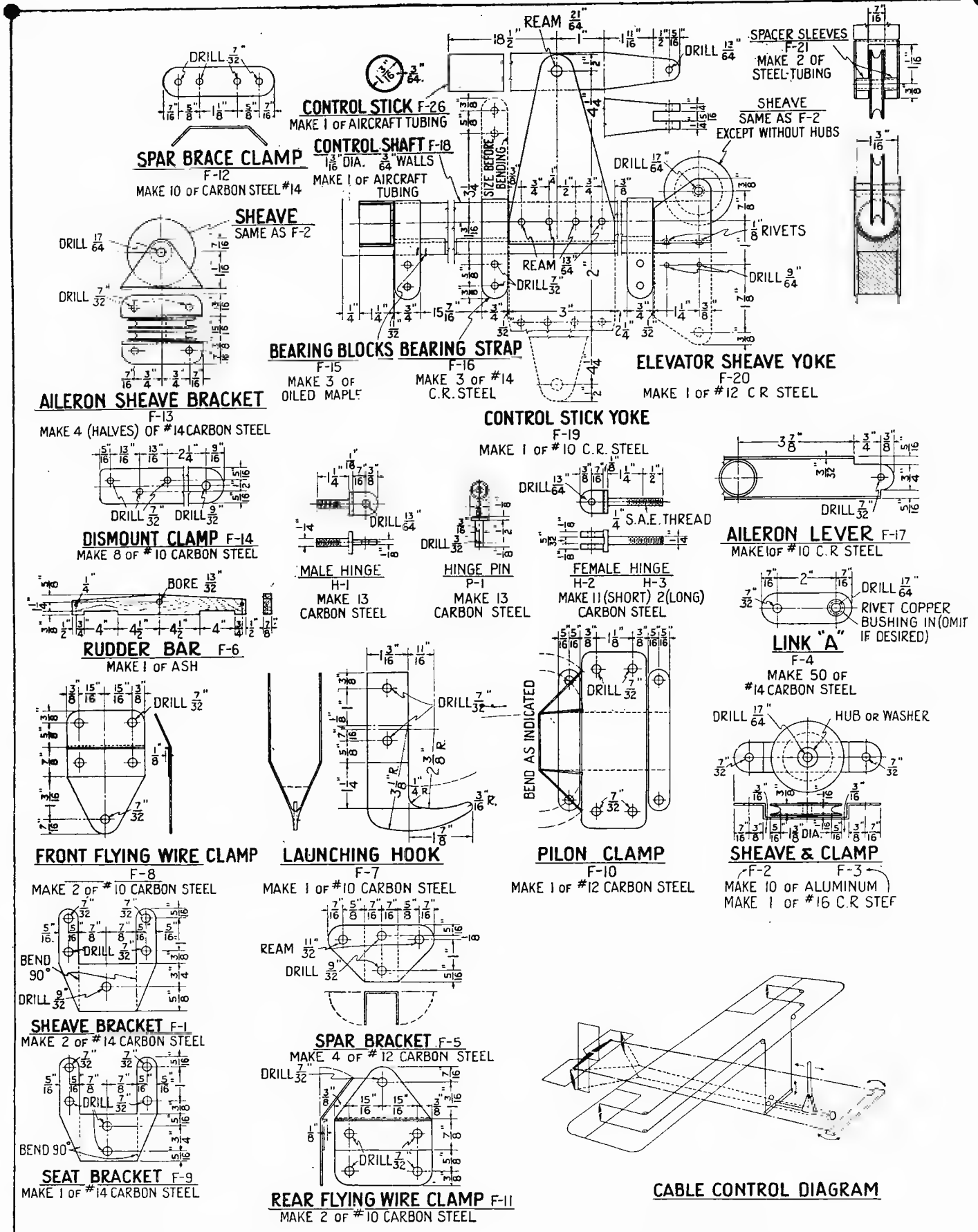
Five methods of launching a glider were presented in Part I of this article, but other methods will suggest themselves.



The above photograph shows a glider in soaring flight. The pilot takes advantage of the uprising air currents.

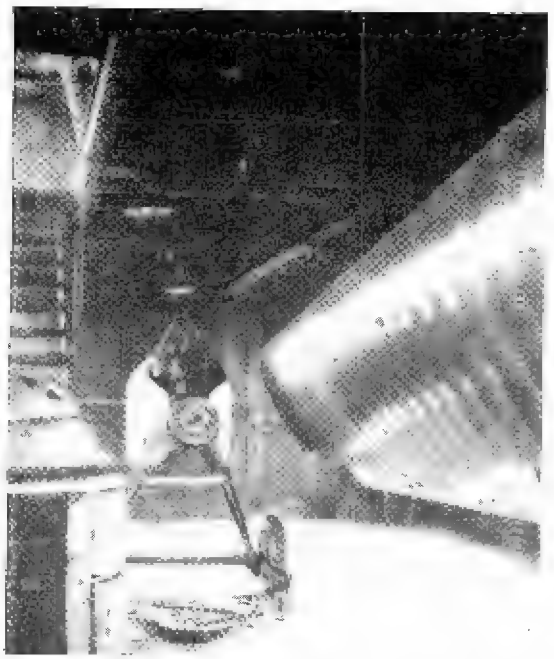
Additional Glider Details

(Described on opposite page)


SPAR BRACE CLAMP F-12
MAKE 10 OF CARBON STEEL #14
CONTROL STICK F-26
MAKE 1 OF AIRCRAFT TUBING
CONTROL SHAFT F-18
1/16" DIA. 3/64" WALLS
MAKE 1 OF AIRCRAFT TUBING
SPACER SLEEVES F-21
MAKE 2 OF STEEL TUBING
SHEAVE
SAME AS F-2
EXCEPT WITHOUT HUBS
SHEAVE
SAME AS F-2
AILERON SHEAVE BRACKET F-13
MAKE 4 (HALVES) OF #14 CARBON STEEL
BEARING BLOCKS F-15
MAKE 3 OF OILED MAPLE
BEARING STRAP F-16
MAKE 3 OF #14 C.R. STEEL
ELEVATOR SHEAVE YOKE F-20
MAKE 1 OF #12 C R STEEL
CONTROL STICK YOKE F-19
MAKE 1 OF #10 C.R. STEEL
DISMOUNT CLAMP F-14
MAKE 8 OF #10 CARBON STEEL
MALE HINGE H-1
MAKE 13 CARBON STEEL
HINGE PIN P-1
MAKE 13 CARBON STEEL
FEMALE HINGE H-2 H-3
MAKE 11 (SHORT) 2 (LONG) CARBON STEEL
AILERON LEVER F-17
MAKE 1 OF #10 C.R STEEL
RUDDER BAR F-6
MAKE 1 OF ASH
LINK "A" F-4
MAKE 50 OF #14 CARBON STEEL
RIVET COPPER BUSHING IN (OMIT IF DESIRED)
FRONT FLYING WIRE CLAMP F-8
MAKE 2 OF #10 CARBON STEEL
LAUNCHING HOOK F-7
MAKE 1 OF #10 CARBON STEEL
PILON CLAMP F-10
MAKE 1 OF #12 CARBON STEEL
BEND AS INDICATED
SHEAVE & CLAMP F-2 F-3
MAKE 10 OF ALUMINUM
MAKE 1 OF #16 C.R STEEL
HUB OR WASHER
SHEAVE BRACKET F-1
MAKE 2 OF #14 CARBON STEEL
BEND 90°
SPAR BRACKET F-5
MAKE 4 OF #12 CARBON STEEL
SEAT BRACKET F-9
MAKE 1 OF #14 CARBON STEEL
REAR FLYING WIRE CLAMP F-11
MAKE 2 OF #10 CARBON STEEL
CABLE CONTROL DIAGRAM

In the above illustration constructional details for the spar brace clamp, control shaft, aileron sheave bracket, dismount clamp, rudder bar, front flying wire clamp, seat bracket, spar bracket, rear flying wire clamp and launching hook will be found. Further details appear in the June number.

Plans for the elevator sheave yoke, control stick yoke, aileron lever and pilon clamp will be found above. The control cables should be arranged as shown in the diagram. It is important that these should work freely, for if they stick while in mid-air, disastrous results may be liable to follow.



The above photograph shows the monoplane in the author's workshop in the process of construction. The view shown was taken when the plane was nearly finished.

How To Build Your Own Airplane

PART II

By GEORGE A. GERBER

Building Your Own Monoplane May Sound Like a Huge Undertaking but Actually It Is Not at All Difficult if One Follows the Directions Given in This and the Preceding Article Which Appeared in the June Issue. The Plans Are Exceptionally Good

FOR instruments the following are needed; the first three being absolutely necessary to the pilot's safety even on short flights: Tachometer (rev. indicator), oil gauge, temperature gauge, altimeter. Bank and turn indicator, air speed indicator, etc., are not of as great importance as the first named. For a temperature gauge, one of the distant reading type, mounted on the dash, is the most reliable.

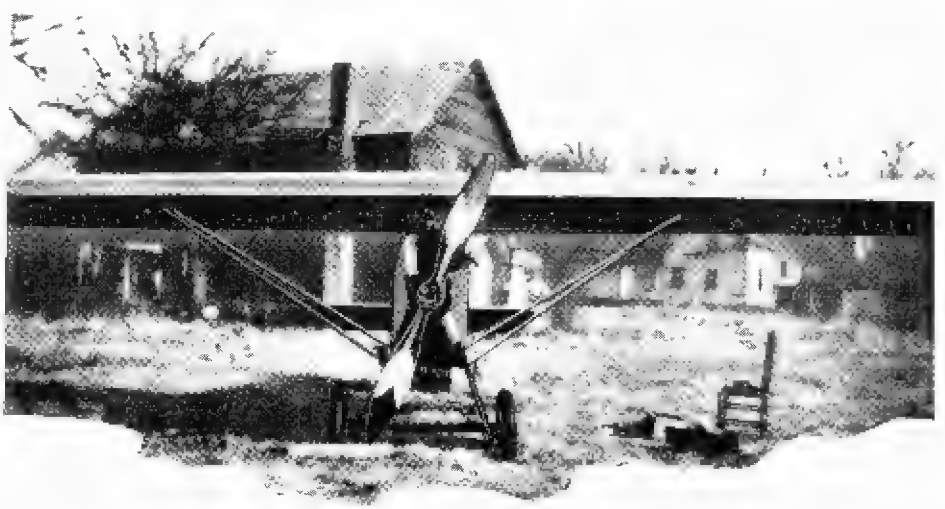
Do not trust a "moto-meter," installed in the radiator cap.

We resume our preparation of the machine proper.

The landing gear should be set up next; land gear cables must be very tight, but not to the point of straining any of the ship's structure. The drawing clearly shows how the shock cord, ½ inch rubber cord made expressly for this purpose, is wrapped in six complete turns, and perhaps eight if the original tension is not correct.

The ship, fully loaded, should not sag on the cord, but the axle should remain tight to the gear until forced up by the shock of landing or passing over a bump.

Do not get the cord too tight or there will be danger of a rupture of some part of the structure during sudden heavy stress.



The finished home-built monoplane is shown above. The design of the ship has proven to be exceptionally stable and safe. The plane is therefore excellent for training.

A bird's-eye photograph taken from the monoplane while in actual flight is shown above. After you have learned to handle the ship, you can take many unique aerial photos.

The drawing shows the construction of the motor-mount, built up of steel tube and angle iron for the bed. The length of this bed cannot always be exactly given, as changes in construction of power plant may require a different point of suspension for perfect balance. The bed should be left long enough to slide the motor forward and backward until balanced, and the excess material of the bed is then sawed off.

Now we come to the heart of the ship, the power plant. Here I can only tell you of the ship I built; you can do as you please, but I advise sticking to specifications strictly.

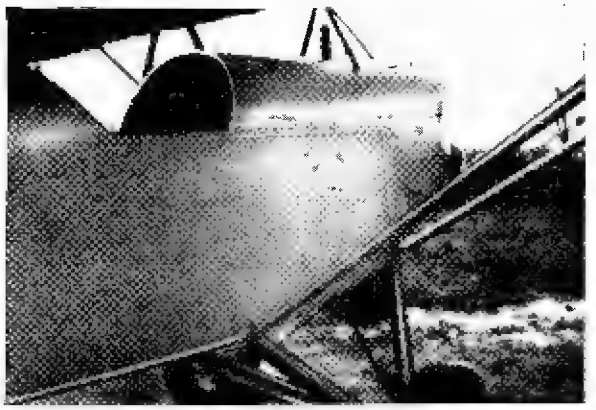
A regular type 490 Chevrolet, 4-cylinder engine was bought from a junk man. It was rebored and fitted with oversize (Dow) metal pistons of aluminum alloy. The flywheel was removed and a special propeller hub was made, which was drilled to match the flywheel bolt holes in the crank shaft flange.

A Chicago aircraft supply concern, I believe, carries these hubs in stock, or they can be made up by any good machinist.

The bearings should be fitted perfectly and the whole job should be test run for at least ten hours before attempted flight. The engine should idle smoothly and respond to wide-open

Instrument Requirements and Hints on Flying Given Here

CONCLUDING details of the construction, the choice of instruments and the installation of the motor are given in this article. For those who cannot avail themselves of a flight training, it must be remembered that self-instruction may be both costly and dangerous. However, the author presents in some detail a method for learning to fly the plane without the aid of an experienced pilot. While many have taught themselves to fly, $100 spent for training is an investment which will never be regretted, considering the possibility of wrecking the plane, not to mention the hazards of bodily injury.



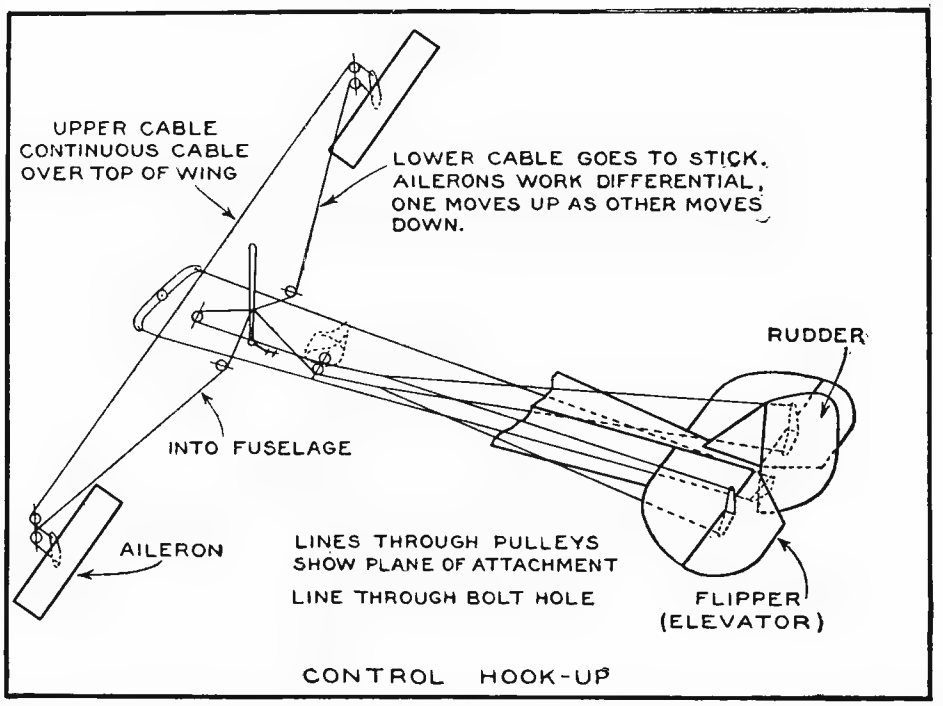
A side view of the ship, showing the cockpit, appears above. The top of the instrument board may be seen, and a tachometer, oil gauge, temperature gauge, and altimeter are absolutely necessary. Bank and turn indicator and air speed indicator are not so important as the first named instruments.

throttle without choking.

A Simms high tension magneto was fitted in generator position.

A Lawrence 28 h.p. propeller was used by us with great success; it was 6′ 6″ in diameter by 3′ 3″ in pitch, and was driven up to 1,850 r.p.m.

Here is a point open to argument. We used no thrust bearing, allowing the crank shaft and center main bearing collars, which are of comparatively large area, to serve as a thrust bearing; this they did on a 50-hour test, at the termination of which a check-up showed an end play of only three thousandths of an inch.


UPPER CABLE CONTINUOUS CABLE OVER TOP OF WING
LOWER CABLE GOES TO STICK. AILERONS WORK DIFFERENTIAL, ONE MOVES UP AS OTHER MOVES DOWN.
RUDDER
INTO FUSELAGE
AILERON
LINES THROUGH PULLEYS SHOW PLANE OF ATTACHMENT
LINE THROUGH BOLT HOLE
FLIPPER (ELEVATOR)
CONTROL HOOK-UP

The control hook-up is shown in the above illustration. In rigging the controls a little observation of other types would be of assistance. The cables should have no slack, yet should not be tight, lest any strain should be put on the surfaces. A good rule is to have them tight enough so that when the stick is moved ⅛ inch, the control starts to move.

Of course a thrust bearing is recommended and may be installed on the fan belt pulley end of the shaft against the front of the crank case (rear as used for airplane).

A more efficient position is at the propeller-hub end of shaft in a special housing, using a special stub shaft which must be made for this purpose.

This power plant has proven to be remarkably flexible, reliable and economical both in fuel consumption and upkeep, and this is a real item when one thinks in terms of an O X 5 or Hisso Solo Ship. With the Lawrence propeller revolving up to 1,850 at top speed, approximately 60 to 65 m.p.h. is obtainable.

A Fordson tractor radiator core was cut down to an area of 160 sq. in., which keeps the engine at a temperature of 140 degrees. The radiator was slung underneath and formed the motor bed.

The regular water pump, less the fan, driven by "V" belt from the crank shaft pulley was used. An expansion tank of one gallon capacity was used in this system.

Now that is about all the data I can give you on this job.

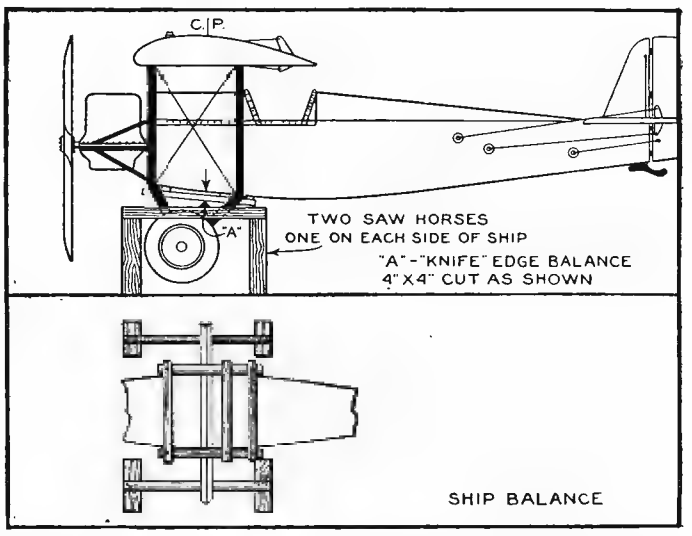
I simply have experimented widely in this game, and I only desire to pass on a few details which may help some puzzled amateur on the road to success.

I have racked my brains many a time when trying to solve some problem of construction from so-called blueprints, which seemed to be sadly lacking in "details," and I have tried to make these drawings very complete, but, again, as I have told you, if I were to try to insert every detail and to go through every motion of construction for you, this article would probably run into volumes.

Simply do your work carefully; use the best of materials mixed with a good amount of originality; stick to it, and you will be rewarded by success. By originality you can dope out the little things for yourselves.

I do not mean that you should radically alter the

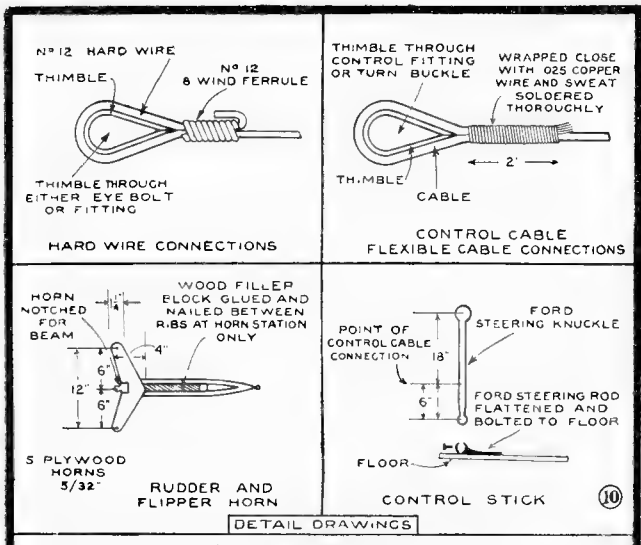
(*Continued on page 278*)



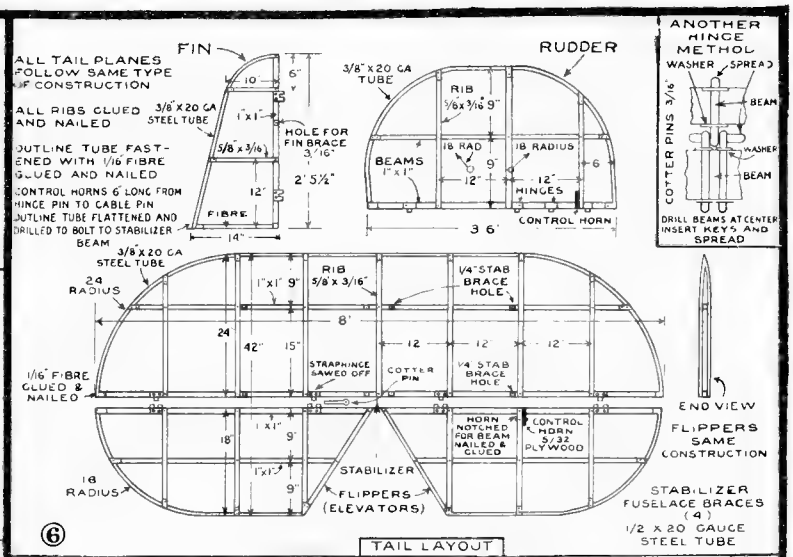
The ship is balanced on two saw horses. "A" is a knife-edge balance, made from 4"×4" stuff.

Plans for Home Built Monoplane

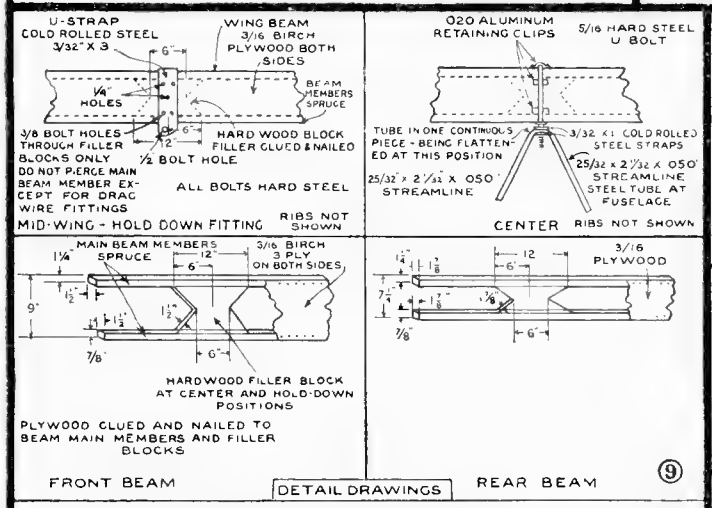
(Described on previous page)



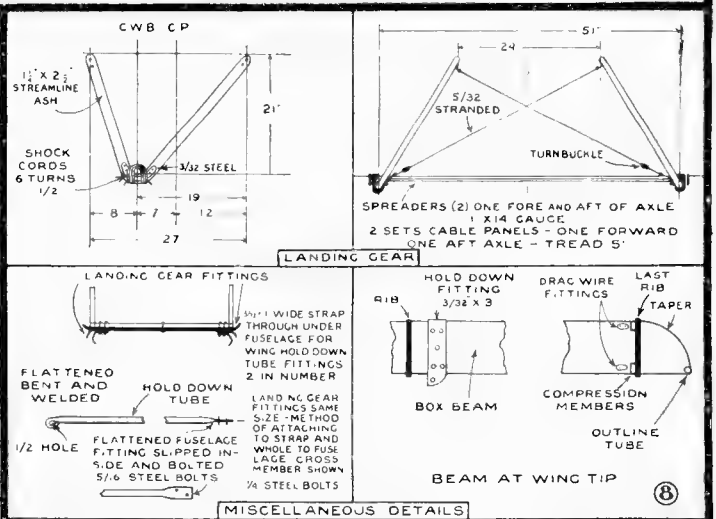
The above drawing shows how to make the hard wire and flexible cable connections, as well as rudder and flipper "horn" details and manner of fixing control stick.



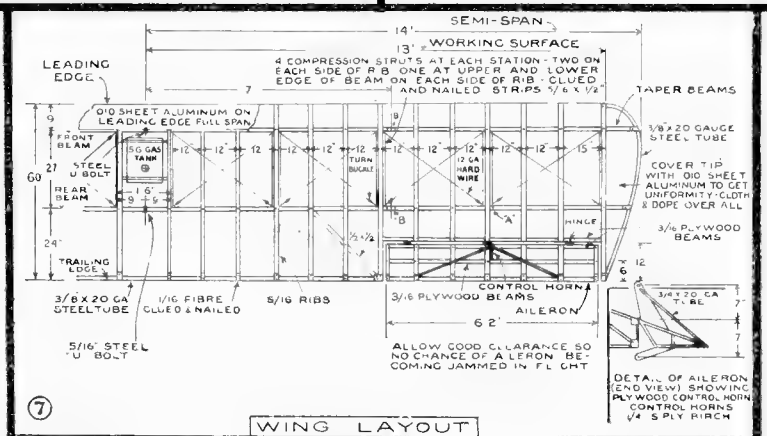
The tail layout is shown above. All tail planes follow the same type of construction, and all ribs are glued and nailed. The outline tube is fastened with 1/16 inch fibre also glued and nailed.


U-STRAP COLD ROLLED STEEL 3/32"X3
WING BEAM 3/16 BIRCH PLYWOOD BOTH SIDES
1/4" HOLES
BEAM MEMBERS SPRUCE
3/8 BOLT HOLES THROUGH FILLER BLOCKS ONLY DO NOT PIERCE MAIN BEAM MEMBER EXCEPT FOR DRAG WIRE FITTINGS
HARD WOOD BLOCK FILLER GLUED & NAILED
1/2 BOLT HOLE
ALL BOLTS HARD STEEL
MID-WING - HOLD DOWN FITTING
RIBS NOT SHOWN
020 ALUMINUM RETAINING CLIPS
5/16 HARD STEEL U BOLT
TUBE IN ONE CONTINUOUS PIECE - BEING FLATTENED AT THIS POSITION
3/32 x1 COLD ROLLED STEEL STRAPS
25/32 x 2 1/32 x 050" STREAMLINE
25/32 x 2 1/32 x 050" STREAMLINE STEEL TUBE AT FUSELAGE
CENTER
RIBS NOT SHOWN
MAIN BEAM MEMBERS SPRUCE
3/16 BIRCH 3 PLY ON BOTH SIDES
HARDWOOD FILLER BLOCK AT CENTER AND HOLD-DOWN POSITIONS
PLYWOOD GLUED AND NAILED TO BEAM MAIN MEMBERS AND FILLER BLOCKS
FRONT BEAM
3/16 PLYWOOD
REAR BEAM
⑨
DETAIL DRAWINGS

Detailed drawings of the hold-down fitting and front and rear beam appear above. The mid-wing hold-down fitting is made of U-strap cold rolled steel. All bolts are of hard steel. The main beam members are of spruce.


CWB CP
1 1/2" x 2 1/2" STREAMLINE ASH
SHOCK CORDS 6 TURNS 1/2
3/32 STEEL
LANDING GEAR
5'1"
24"
5/32 STRANDED
TURNBUCKLE
SPREADERS (2) ONE FORE AND AFT OF AXLE 1 X14 GAUGE 2 SETS CABLE PANELS - ONE FORWARD ONE AFT AXLE - TREAD 5'
LANDING GEAR FITTINGS
FLATTENED BENT AND WELDED
HOLD DOWN TUBE
1/2 HOLE
FLATTENED FUSELAGE FITTING SLIPPED INSIDE AND BOLTED 5/16 STEEL BOLTS
LANDING GEAR FITTINGS SAME SIZE - METHOD OF ATTACHING TO STRAP AND WHOLE TO FUSELAGE CROSS MEMBER SHOWN
1/4 STEEL BOLTS
HOLD DOWN FITTING 3/32 x 3
RIB
DRAG WIRE FITTINGS
LAST RIB
TAPER
BOX BEAM
COMPRESSION MEMBERS
OUTLINE TUBE
BEAM AT WING TIP
⑧
MISCELLANEOUS DETAILS

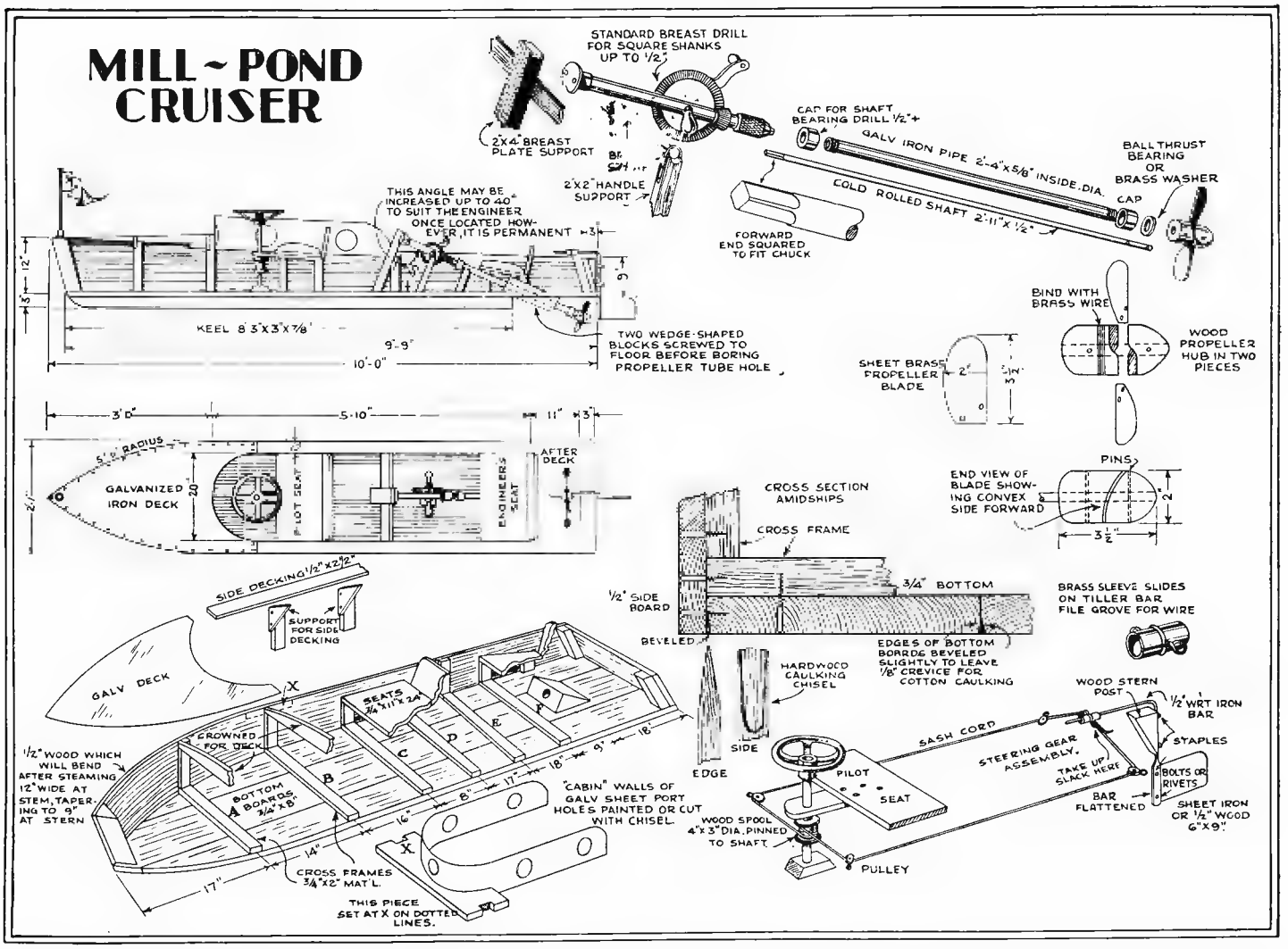
Various miscellaneous details will be found in this drawing as well as plans for the landing gear. By referring to the landing gear details, it will be seen that two spreaders are used, one fore and one aft of the axle.


SEMI-SPAN
14'
13' WORKING SURFACE
LEADING EDGE
4 COMPRESSION STRUTS AT EACH STATION - TWO ON EACH SIDE OF R B ONE AT UPPER AND LOWER EDGE OF BEAM ON EACH SIDE OF RIB - GLUED AND NAILED STRIPS 5/16 x 1/2
TAPER BEAMS
010 SHEET ALUMINUM ON LEADING EDGE FULL SPAN
FRONT BEAM
5G GAS TANK
STEEL U BOLT
REAR BEAM
TURN BUCKLE
12 GA HARD WIRE
3/8 x 20 GAUGE STEEL TUBE
COVER TIP WITH 010 SHEET ALUMINUM TO GET UNIFORMITY - CLOTH & DOPE OVER ALL
3/16 PLYWOOD BEAMS
HINGE
TRAILING EDGE
3/8 X 20 GA STEEL TUBE
1/16 FIBRE GLUED & NAILED
5/16 RIBS
CONTROL HORNS
3/16 PLYWOOD BEAMS
AILERON
6'2"
ALLOW GOOD CLEARANCE SO NO CHANCE OF AILERON BECOMING JAMMED IN FLIGHT
5/16" STEEL U BOLT
DETAIL OF AILERON (END VIEW) SHOWING PLYWOOD CONTROL HORN CONTROL HORNS 1/4 5 PLY BIRCH
⑦
WING LAYOUT

The layout for the wing is illustrated above. The semi-span is 14 ft. The ribs are glued and nailed to beams and the compression pieces glued and nailed to both ribs and beams. "B" are hold down fittings (1/8 in. x 3 in. steel U fittings). "A" is a 5/16 in. steel bolt piercing beam for attaching aileron pulleys. One set of drag bracing at upper and lower edge of beams reduces the possibility of wing flutter. The wing tip is covered with aluminum.

THE constructor must remember that it is impossible to insert all small details and go through every phase of the construction. By doing the work carefully and planning out the little things, an excellent job will result. Do not radically alter the design of the ship, unless you know definitely that an improvement will result by so doing. The monoplane described here has proven to be both stable and safe. The airfoil has no sharp purple point and will mush along at altitudes which could not be done with many other types of planes. Airplanes powered with small engines fly like butterflies and require an experienced pilot for them.

IN continuing the construction of the plane which was partially described last month, the landing gear should be next set up and the gear cables tightened, but not enough to strain any of the structure. When the ship is fully loaded it should not sag on the cord and the axle must remain tight to the gear. The shock cord is ½ in. rubber cord made expressly for this purpose. A four cylinder Chevrolet type 490 engine is used for the power plant. The flywheel must be removed and a special propeller hub made and drilled to match the flywheel bolt holes in the crank-shaft flange. The hubs can be bought or made by a good machinist.


MILL~POND CRUISER
STANDARD BREAST DRILL FOR SQUARE SHANKS UP TO ½"
2"X4" BREAST PLATE SUPPORT
2"X2" HANDLE SUPPORT
CAP FOR SHAFT BEARING DRILL ½"+
GALV IRON PIPE 2'-4"X5/8" INSIDE DIA.
BALL THRUST BEARING OR BRASS WASHER
CAP
COLD ROLLED SHAFT 2'-11"X ½"
FORWARD END SQUARED TO FIT CHUCK
THIS ANGLE MAY BE INCREASED UP TO 40° TO SUIT THE ENGINEER ONCE LOCATED HOWEVER, IT IS PERMANENT
KEEL 8'3"X3"X7/8"
9'-9"
10'-0"
TWO WEDGE-SHAPED BLOCKS SCREWED TO FLOOR BEFORE BORING PROPELLER TUBE HOLE
BIND WITH BRASS WIRE
WOOD PROPELLER HUB IN TWO PIECES
SHEET BRASS PROPELLER BLADE
3'0"
5'10"
11"
5½" RADIUS
GALVANIZED IRON DECK
PILOT SEAT
ENGINEERS SEAT
AFTER DECK
END VIEW OF BLADE SHOWING CONVEX SIDE FORWARD
PINS
CROSS SECTION AMIDSHIPS
CROSS FRAME
¾" BOTTOM
½" SIDE BOARD
BEVELED
EDGES OF BOTTOM BOARDS BEVELED SLIGHTLY TO LEAVE ⅛" CREVICE FOR COTTON CAULKING
BRASS SLEEVE SLIDES ON TILLER BAR FILE GROVE FOR WIRE
SIDE DECKING ½"X2½"
SUPPORT FOR SIDE DECKING
GALV DECK
SEATS ¾"X11"X24"
CROWNED FOR DECK
½" WOOD WHICH WILL BEND AFTER STEAMING 12" WIDE AT STEM, TAPERING TO 9" AT STERN
BOTTOM BOARDS ¾"X8"
"CABIN" WALLS OF GALV SHEET PORT HOLES PAINTED OR CUT WITH CHISEL
CROSS FRAMES ¾"X2" MAT'L.
THIS PIECE SET AT X ON DOTTED LINES.
HARDWOOD CAULKING CHISEL
SIDE
EDGE
WOOD STERN POST
½" WRT IRON BAR
STAPLES
SASH CORD
STEERING GEAR ASSEMBLY.
TAKE UP SLACK HERE
BOLTS OR RIVETS
BAR FLATTENED
SHEET IRON OR ½" WOOD 6"X9"
PILOT
SEAT
WOOD SPOOL 4"X3" DIA. PINNED TO SHAFT
PULLEY

The above drawing gives all the necessary details for constructing the small cruiser powered by a breast drill. The ample beam makes this a remarkably seaworthy craft under ordinary conditions.

There are no difficulties in the building and the hardest jobs are fitting the side boards around the curve in the bow and making the propeller hub.

A Hand-Propelled Boat for the Kiddies

By HI SIBLEY

Mill Pond Cruiser Can Be Adapted to Power Installation with Small Bike Motor

THERE is a fascination about propeller-driven boats not found in any other type of craft. It is not wise, however, to turn inexperienced youngsters loose in a motor boat to face the hazards of a large body alone.

By making this staunch little hand-propelled cruiser, the boys can enjoy all the thrills of cruising and acquire much valuable knowledge of navigation without any of its perils. Incidentally, the young sailors will never get very far from the home port.

Construction

THERE are no tricks to the construction of this boat. The most difficult jobs are in fitting the side boards around the curve of the bow, and in making the propeller hub. By selecting the kind of wood available in your section that is most easily bent, and by steaming the forward end, construction of the hull presents no difficulties. Possibly you can find a wood ½-inch thick that will bend readily without steam treatment. If not, a steam box is easily made—simply an old packing box about 3 feet 6 inches long, 15 inches wide and a few inches high, with a slot in one end to receive the board. Set it up on saw-horses; bore a hole in the bottom near one end, insert a short piece of hose, slip the other end over a teakettle, and start the kettle to boiling. Stuff paper or rags in the cracks and steam the board for two or three hours. It will then bend easily around the bow end of the bottom pieces.

But first make the bottom, using three ¾-inch boards, 8 inches wide, held together by the cross pieces A, B, C, D, E and F. Cross frames A and B are braced by the crowned thwarts which are to support the forward deck. A temporary thwart can be nailed across the top of frame E while screwing on the side boards. The stern piece should also be set. It is best to begin fastening the side boards at the stern and working forward.

Note that the edges of the bottom boards are slightly beveled to leave a V-shaped crack about ⅛-inch wide for the cotton caulking. Before driving the cotton in, apply white lead liberally in the cracks. Then, with a hardwood caulking chisel that does not come quite to a sharp point (otherwise it will catch in the cotton and pull it out again) drive in twisted cotton. Pack it well, so that it does not bulge above the surface. Slosh white lead liberally over the cotton. Take pains to have the bottom boards fit snugly together, and make as neat a job as possible with the caulking. This will save you much grief later.

(*Continued on page* 268)

Artistic Hardwood Floors

By J. E. LOVETT

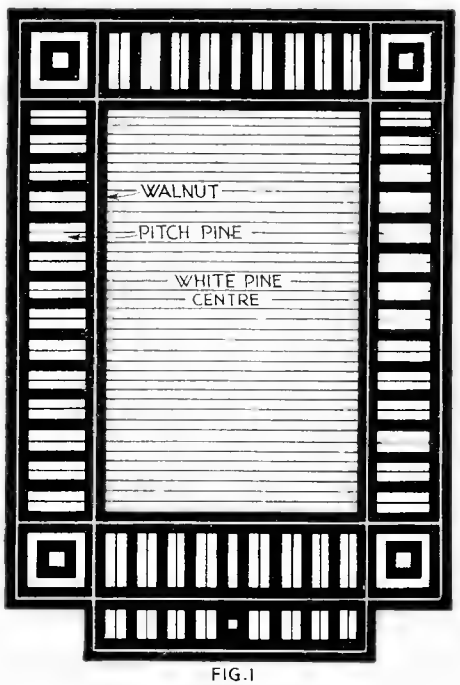


FIG. 1

To give an artistic effect as well as to produce a contrasting result in the design, a floor such as shown above is very beautiful. The border here is laid with walnut and pitch pine.

A GOOD floor is something to be proud of—a poor one something to hide. The days when the entire floors from wall to wall should be covered with oilcloth, carpet, and matting have passed, and today the modern house glows in its partially exposed, and partially rug-covered floor. In the average house for the living room, dining-room and bedrooms, wood-covered floors have been found most satisfactory. For the porch or the vestibule, which is often exposed to the weather, a more waterproof material is required, with the result that cement and tile is much in use. For the kitchen or kitchenette, although wood is very often used, a material which is more waterproof and resilient is desirable; while for the bathroom, a seamless floor covering seems to answer best. It will thus be seen that the majority of floor areas will be of wood. Floors in most cases are laid with straight joints, in which the side joints of the boards are continuous throughout their length. In ordinary work, the boards are laid down, the one after the other, and are nailed through the feather edge. Where the boards are wide, a nail is put through the face midway between the front and back edge.

The oak floor, on account of its attractive grain and excellent wearing qualities, is widely used for the better class of work. Such flooring is milled, tongued, and grooved, and can be had in various thicknesses. The laying of oak flooring is not difficult, but some judgment and care is necessary in order to procure the best results. The nailing of oak flooring is very important. All tongued and grooved flooring should be blind nailed (nailed through the edge). The best flooring can be spoiled by using improper nails. The steel cut variety is recommended for edge nailing.

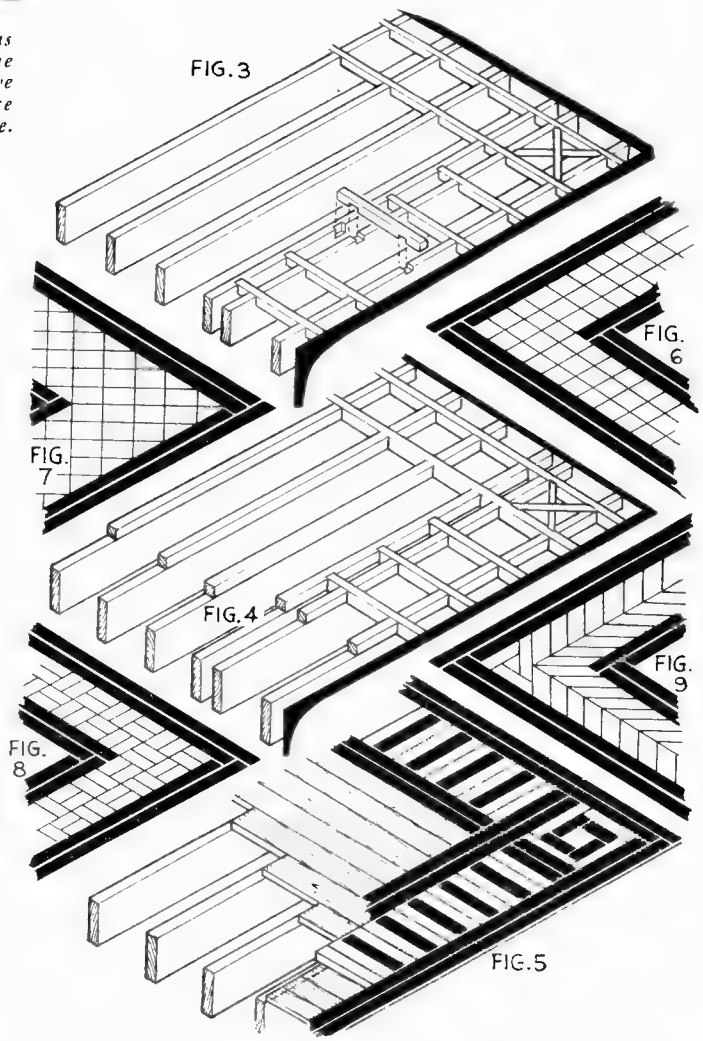
With the wide use of rugs in homes and offices, an economical method is to have the center portion of the room laid with pine, employing oak for the border. When the rug is laid, the visible portion of the floor will have the best appearance at a less initial cost. A room measuring 12 feet by 14 feet, for example, might have a 2-foot border laid with oak flooring of a 3-inch wide pattern. Maple flooring has excellent wearing qualities, but lacks the attractive grain of the oak, and hence is little used for the house flooring.

Special floors are often constructed in which various timbers are used to give a contrasting effect in the design. A floor such as this is shown at Fig. 1, in which the border was laid with walnut and pitch pine. The great difficulty in setting off the floor boards to a pattern design, and where the floor covering is formed in one layer, is the arranging of the joists. Fig. 2 shows the arrangement of the joist and bearer plan for this floor. The plan shows an extra joist at the inner edge of the border. This close-up space would be required at both sides of the room, and the other joists would require to be especially divided out to meet the needs of the design.

Another point which should be carefully considered is, will the scantling of the joists allow the notches to be cut for the bearer pieces without weakening the framing too much? Fig. 3 shows how the bearers would be set out and checked into the joists, while Fig. 4 gives an arrangement in which the joists are laid a distance below the other floor joists equal to the thickness of the bearer pieces. In that the bearer pieces are laid on the joists, the transverse pieces being fixed first, and those which are parallel to the existing joists are fitted in between.

In building a floor covering of this type all the flooring should be blind nailed,

(*Continued on page 271*)



This illustration shows designs for parquet flooring. Such flooring is composed of thin layers of wood, worked in geometrical patterns, and different patterns used for borders. The parquet may be laid directly on the joists, although it is best laid on a sub-floor. The sub-floor has the advantage that the finished floor can be laid down and the pieces nailed as fast as the pattern is outlined.

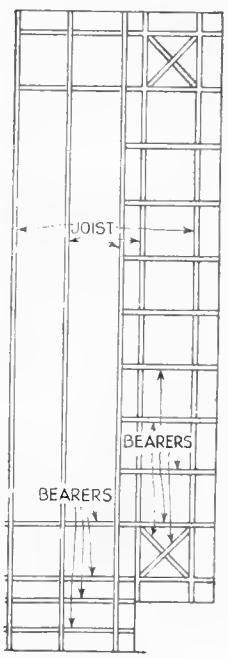


FIG. 2

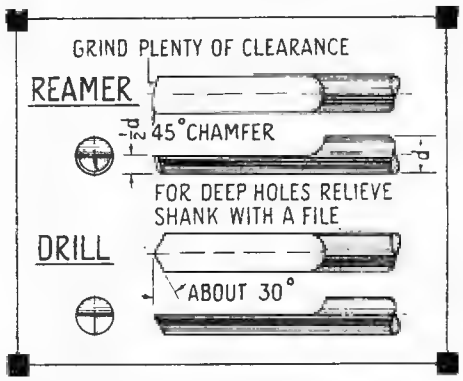
This illustration shows the joist and bearer plan of the hard wood floor, in Fig. 1.

The Editors will Welcome Contributions to This Department. Sketches Should Accompany All Manuscripts Whenever Possible.

Shop Mechanics

If You Have Any Time and Labor Saving Kinks which Will Help the Mechanic, Submit Them to the Editor.

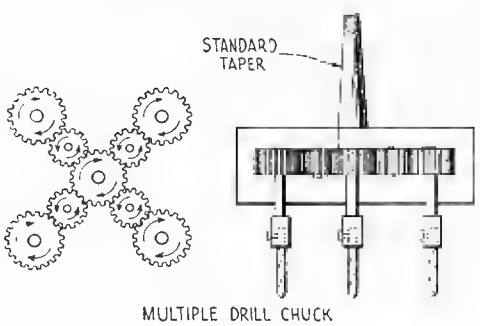
Substitute Reamer



The above illustration shows two substitute reamers, one of which can be used for drilling deep holes.

A SUBSTITUTE reamer which has been used with good success in reaming camshafts for pressure lubrication is shown in the drawing. By changing the cutting angle, it can be used for the pilot drill, and in fact it may be employed to a large extent in drilling deep holes in guns. Camshafts 42 in. deep have been drilled with such a reamer by using care and oiling frequently. For deep holes, the shank is relieved with a file. For use as a reamer the end is ground to a 45-degree chamfer and for use as a drill a 30-degree point is made. —*E. W. Merril.*

Multiple Drill Chuck

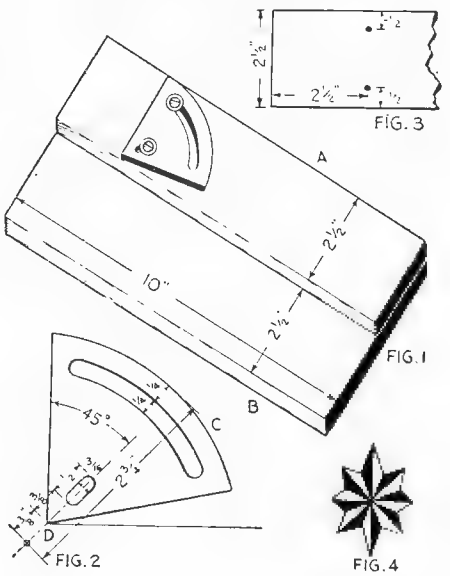


The above drawing shows how a multiple drill chuck can be made with a number of gears. A standard taper is attached to the center or driving gear.

WHEN a number of pieces must be drilled and the holes must have the same arrangement, a multiple drill chuck such as that shown will save much time and also assure accuracy. The center or driving gear turns the other gears which hold the drill points as they revolve. A standard taper allows the chuck to be used with any drill.—*H. W. S.*

Shooting Board

FIRST PRIZE, $10.00



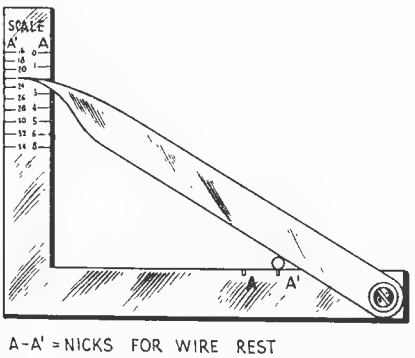
Above—Fig 1, base of board; Fig. 2, the stop; Fig. 3, shows how stop is held by screws, and Fig. 4 is a sample star.

A SMALL shooting board with a movable stop enables one to make any number of inlaid stars of different patterns. The base A of the board is shown in Fig. 1, upon which lies the top piece B. The stop C, Fig. 2, is slotted to the dimensions shown. Care must be taken to place the screws as shown in Fig. 3, so that the top, D, can always be placed flush with the board B. It is suggested to use a steel rebate plane for shooting the wood for the stars. Templates are useful for setting the top according to the number of pieces required in the inlaid star.—*J. E. Lovett.*

PRIZE AWARD

Each month $10.00 will be given to the contributor of the best shop wrinkle. Shop Mechanics is a new department which first appeared in the June issue of this magazine. Garage men, shop workers, and those engaged in similar occupations will find much of interest on this page and are asked to submit their own favorite kinks to the editors.

Wire Gauge

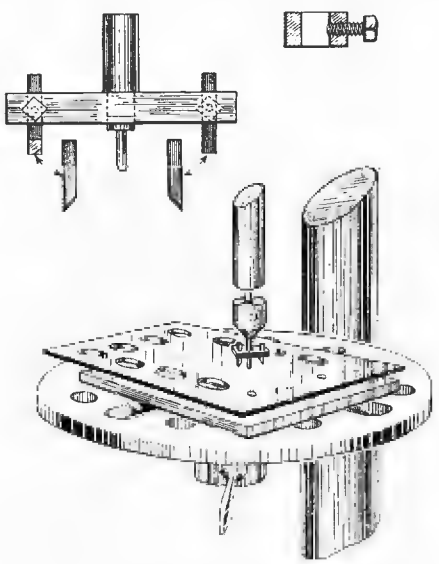


A handy wire gauge for the shop is illustrated above. It consists of two pieces, one L shaped and the other straight, with a pointer ground at one end.

THE wire gauge, made from two pieces of rather stiff stock, is shown above. The horizontal side of the L is nicked for the wire rests. The instrument is calibrated by placing known sizes of wire in one of the rests and scribing the vertical part of the L with a sharp tool.—*W. C. Wilhite.*

Circle Cutter

A CIRCLE cutter is illustrated here and is made from machine or tool steel. A crosspiece holds the toe and heel cutters and a guide projects downward. Holes are first drilled in the crosspiece and then filed square.—*H. W. S.*

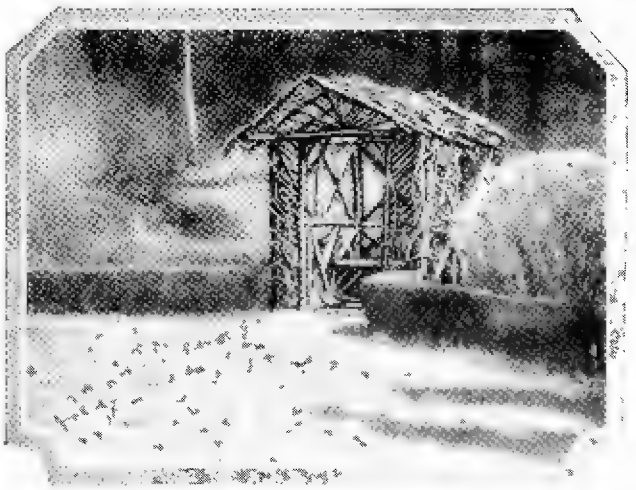


A circle cutter can be made from machine or tool steel, as shown above. A number of holes can be made in the crossbar to accommodate the cutting points for different size holes.

How to Build a Rustic Summer House

By DR. ERNEST BADE

Structure Constructed with Native Wood Presents a Work Using Material in Its Natural Beauty and Provides a Valuable Garden Adjunct



The above photograph shows a view of a summer house built by the author. If desired, a rambler or climbing vine can be trained over the structure.

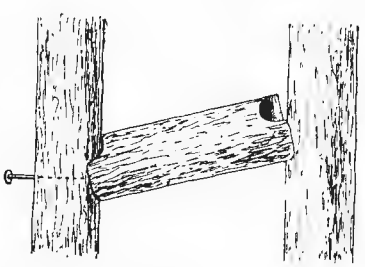
THE summer house should be so situated that it not only merges with the surroundings, but it must also represent a piece of nature in all its natural beauty. This means that the house itself should not be striking in appearance nor glaringly proclaim itself for something that it is not. The rustic summer house should be light and airy, built, preferably, with natural wood with its natural bark. Of course, if desired, a rambler or climbing vine may entwine itself about it so that the direct rays of the sun are cut off, but the growth should not be so dense as to cut off all view from within. Almost any kind of a climber may be used to advantage; the particular ones used must be adapted to the surroundings. The Virginia creeper is excellent for shady places, as it will grow luxuriantly under the shade of tall trees. Other vines may only be used in direct sunlight, as, for instance, the ramblers. Then, too, there are many excellent annual climbers from which to choose those that suit one's taste best.

Frame

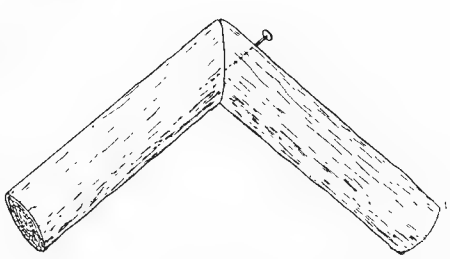
THE frame work of the summer house consists of a number of thick branches or young tree trunks of from four to five or even six inches in diameter. These may be sunk into the ground for two or three feet. The wood selected should be resistant against rot. Such wood may be chestnut, cedar, or locust, or any other of similar character. At this point it may be mentioned that, although locust is one of the best woods for poles or posts, it is exceedingly hard and tough and a nail can only be driven into it with difficulty. If a rot-resisting wood can not be obtained, almost any wood that is available may be used, provided the posts are set in concrete piles, the concrete protecting the posts from soil moisture. Here the holes are dug as usual. The hole is then filled with concrete and the posts set in the soft concrete and more cement poured around the post. The cement should be about four or five inches above the soil. These posts may be spaced from two feet at each corner to three or four feet at each side. The narrow spacing of the posts at the corners is only for greater strength when comparatively thin posts are selected.

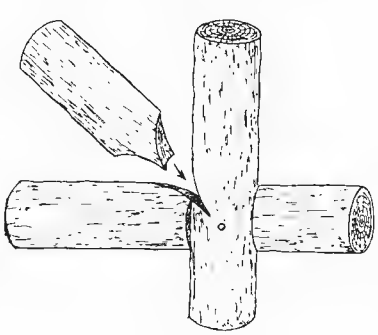
Constructing the Structure

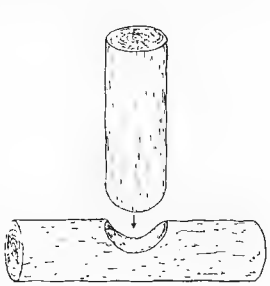
HERE it may again be mentioned that the summer house should be open and lace-like in character. The shorter small branches used to close in the sides should be widely spaced, say from four to six inches or even more apart. While building, do not trim the branches too much. It makes absolutely no difference whether one is three inches in diameter and the next two inches, or if one is four inches longer than the other, or even if a number of bends and crotches are present. Just nail them on where they are supposed to overlap the uprights.

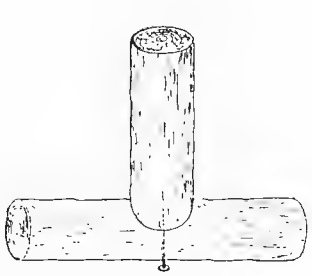


The above drawing shows how a short bar is forced between two uprights. The illustration at the right shows how to make a right angle joint and the drawing below shows method of inserting a short branch in a right angle.

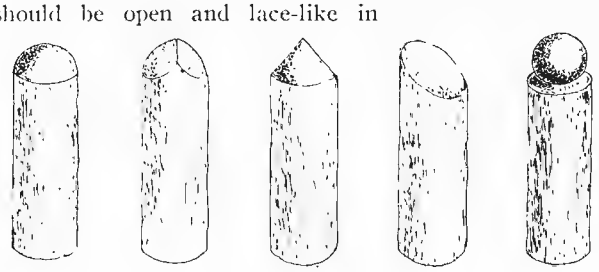








The straight pieces are first hollowed out and then fastened with a nail. If the wood is fresh and still contains sap, it can be more easily worked.



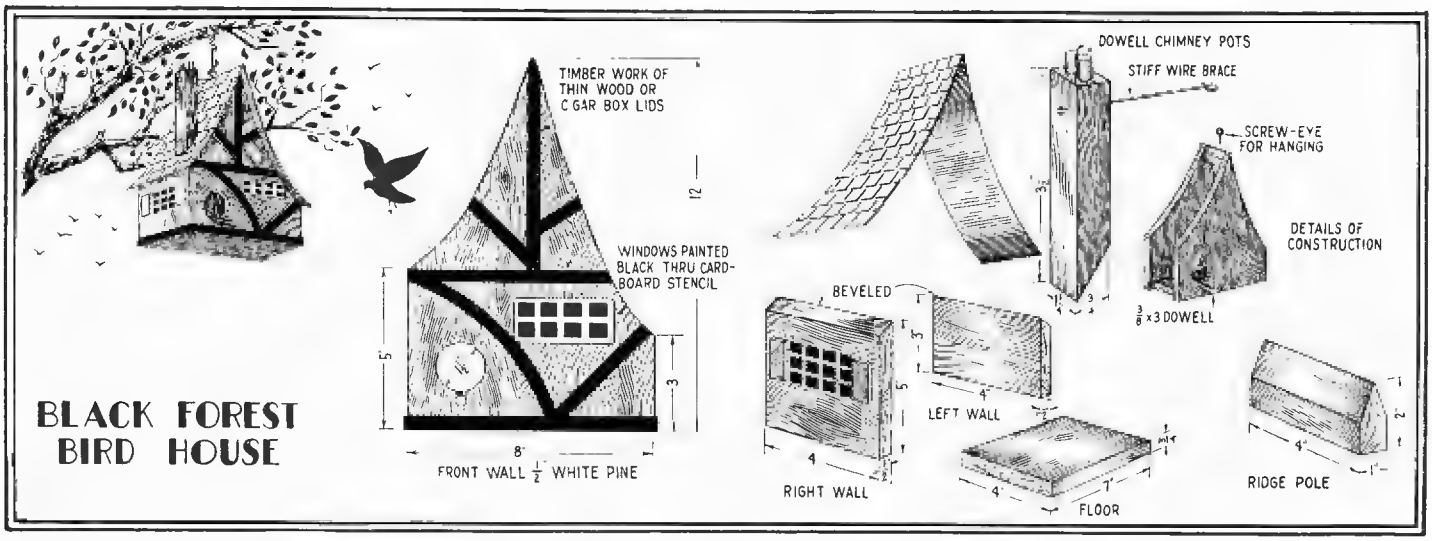
The illustration at the left shows various shapes of end tips. The first is oval, the second a "knife edge," the third a cone, the fourth a simple angle type, and the fifth a ball tip.

Of course, if the branches are to be fitted in between the uprights, care must be taken to cut them just a trifle larger than the distances the uprights are apart. This is necessary, for each end of these short pieces is to be slightly rounded toward the inside. The notch that is cut will keep the branch in position when pressure is applied from either side, even though the nails do not hold firmly.

Type of Wood

THE variously forked and branched pieces are just as valuable as the straight pieces in building such a structure. The main point to watch is that the wood selected is free from rot, especially dry rot.

(*Continued on page 267*)



The above illustration shows the completed bird house and details of the front wall which is made from white pine.

The right wall, left wall, floor, chimney, ridge pole and roof should be made according to the sizes indicated above.

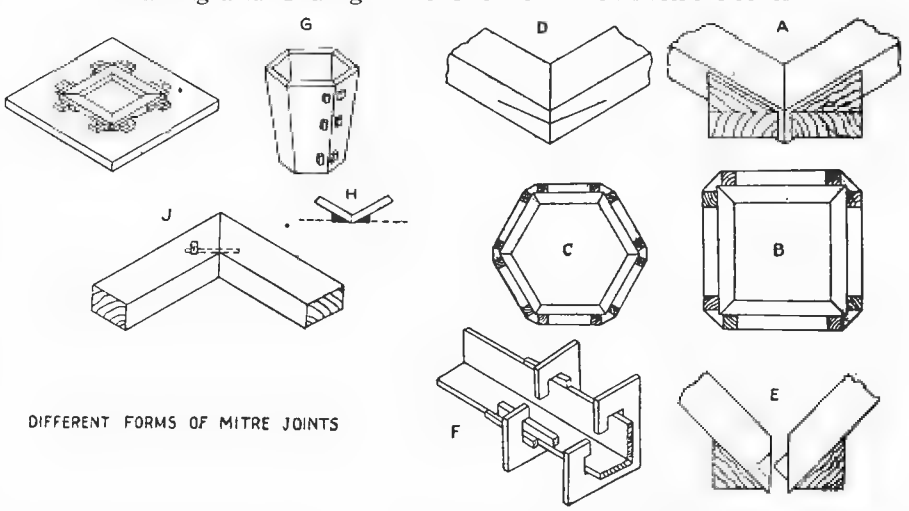
A Black Forest Bird House

A BLACK Forest bird house copied after the rural cottages seen in this forest in Germany can be made from a strip of tin, half inch boards from a packing box, some oil paints, a screw eye and a section of dowel stick. The bottom should be made first and measures 4″ x 7″ x ¾″. Next, the front wall is constructed according to the dimensions given. Any soft wood up to ¼ in. thick can be used for the timber work. Cigar box lids are good for this purpose. Before nailing the timber work, the assembled walls should be given two coats of paint. Cut the roof from tin or light gauge galvanized sheet iron. This will require a strip 6″ x 19½″. The chimney is made from a piece of soft pine and has a small hole near the top for the stiff wire which ties it to the screw eye in the ridge pole. Secure the base of the chimney to the roof with a nail or screw before nailing the roof to the edges of the walls. The roof should now be given a coat of paint. The finished bird house should be suspended from a high place inaccessible to cats.

The house can be attractively finished with the oil paints in any manner desired by the builder.
—*Hi Sibley.*

How To Make It

Making and Gluing Different Forms of Mitre Joints

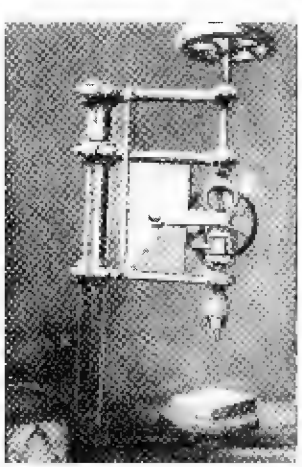


Mitre joints are difficult to fit, but it is often more difficult to maintain the fit when gluing. A few of the more useful methods for gluing are shown.

Mitres

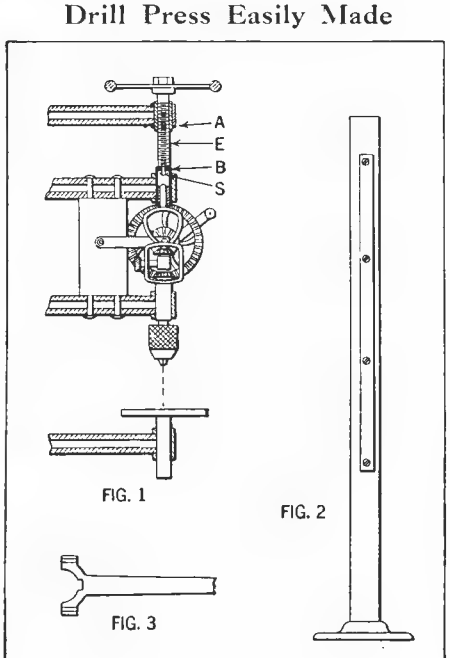
A PLAIN mitre is shown at A. If the frame is not too close, the best method used for joining is to glue deal blocks to the ends. For small frames, illustrated at B and C, the two blocks are left loose and placed at the center of each piece. A piece of string is now passed around the frame and the blocks. E shows the application of the method shown at A to the usual bookcase joint. Another useful method is illustrated at F, and G shows how to use the gluing blocks to provide a hold for the thumbscrews. H shows how pull to the center of joint is obtained, and I shows another method. J shows the procedure employed for joining heavier wood. —*J. E. Lovett.*

Complete Drill for $5.00



Above is a photograph of the completed drill press made from an old hand drill as shown in the illustration at the right. Fig. 1 shows details of drill, fig. 2 is the pipe standard, and fig. 3 shows how the slats are cut from connecting rods.

Drill Press Easily Made



Drill Press

THE handles are removed from an old breast drill, and a bushing, B, fig. 1, made to fit the stub. A hole is bored through the top of the bushing and a screw passed into the elevating Screw E. Ford connecting rods hold the drill. The standard is pipe.—*S. J. McCarroll.*

Readers' Opinions and Comments Will Be Welcomed by the Editors

What Our

Astrology

Editor, SCIENCE AND INVENTION:

It was with great pleasure that I received your copy of the radio talk, "A Year's Investigation Into Astrology."

For years I have been keenly interested in the subject and welcome this other side which allays a number of qualms I have been harboring.

I have had several horoscopes cast, all at different prices, and must admit that while I would not like to think some of the forecasts would materialize, many of them appeared true. Some of the incidents contained therein had actually happened.

Can you account for that? One thing that several astrologers said was that I would probably see my fiftieth year, that my last illness, "some predicting an accident," would be sudden and far from the place of my birth, which was England. Now these statements have always preyed on my mind, although I have never spoken to anyone but you about them, and as I have a young baby it is naturally every mother's wish to live to see her child grown to manhood. I will try from this time to put any or all of the astrologers' forecasts out of my mind. By the way, another said I was in danger when on water, which has prevented me from going to England to see my mother. I take it now that you can and do assure me there is no truth in astrology.

L. J. K.,
New York City.

(We do not know whether you are conversant with SCIENCE AND INVENTION'S attitude toward astrology, but here are just a few high-lights in the case:

In the October, 1927, issue of SCIENCE AND INVENTION magazine we published an astrological contest, in which we offered $5,000.00 in prizes to any astrologer who would correctly mention three events of such a nature that he had no control over the outcome of the same, and would describe those events without contradiction. In addition, we offered $1,000.00 to those astrologers who would correctly give us the outstanding details in the lives of three individuals, whose names were to be unknown, but the birthplaces, times, and dates, as well as locations, were to be given.

We received letters from all over the world; from the best astrologers in India, to the poorest in America; from those in the northernmost climates of Russia to the most southerly part of Autralia. The three birth dates and the other factors were given to all of them, and in addition we stated in the second horoscope:

"In order to double-check on this latter person's life, a very important event occurred on July 30, 1915.

"With regard to the important event mentioned in the second analysis, we would advise that this may be the birth of a son, of a daughter, a serious illness, a recovery from illness, a change of position, the receipt of a large sum of money, a divorce, a marriage, a second marriage, an accident, the loss of a limb, the loss of life, a trip abroad, enlistment into the service in the World War with a foreign contingent, an airplane accident, a train wreck, or what not. You should be able to tell."

Of the thousands of horoscopes which were returned to us, in the answer to this $6,000.00 prize contest, not one of them mentioned this important event correctly, even though forewarned. Only two of them approximated the important event; one of them to the effect that on this date there was a serious illness or death, and the other, "I wouldn't be a bit surprised if the subject met with an accident on this date." Other factors in the life of this same character were hopelessly incorrect. The majority stated that he was a benevolent, law-abiding citizen; a peaceful, cheerful, church-going, brilliant, respectable individual.

The fact of the matter was that he was a convicted murderer and on this particular date was executed for the crime. Evidently the stars had nothing to do with the man's execution, because not one of the astrologers foretold the event or disclosed it as past history.

It is very easy for any astrologer to say "you are going to cross water." If you don't cross the Atlantic Ocean, you may cross the Pacific, and if you don't cross either, why there is the East River, the Hudson River, or even a street puddle. It is a simple matter, also, to say that you will have some trouble while crossing water. It may be anything from getting your shoetops wet during a storm to becoming seasick on an ocean voyage. When one considers the millions of passengers that have been transported from Europe to America, and vice versa, without a loss of life, and practically with no really serious tragedy, we certainly believe that there is but very little room for the fear of danger which is preying on your mind. If astrologers were unable to forecast the truth when the actual facts were known and when $6,000.00 was at stake, how do you expect any one of them to be able to give you a correct delineation for $20.00 to $25.00?

By all means forget astrologers; forget fortune-tellers of all kinds. If the future was an open book to the astrologers, they would be worth billions. It means no more to them than it does to the stray cat or dog.

The next time you feel inclined to go to England to see your mother, pick out a good time for the ocean voyage, when the sea is not too rough, so that you will not be sea-sick en route, laugh at the astrologers and go right ahead.—EDITOR.)

Baldness

Editor, SCIENCE AND INVENTION:

Having read your article on baldness, I feel that I might give some experiences regarding loss of hair that may be of some benefit to others.

Like most people, when I began to lose my hair I tried all sorts of worthless tonics; answered ads; tried almost everything from quacks to so-called specialists, and finally gave it up, until one day I accidentally met a physician with whom I became very friendly. I asked him if it were possible to get back a normal growth of hair. After examining my scalp, he said, "The roots and follicles are alive. . . . I believe you have a favorable case, and if I were you I would go to a qualified skin doctor or dermatologist, but be sure he is ethical and has the respect of the medical fraternity. . . ." In fact, he recommended a dermatologist to whom I am now going. After the scalp was examined, the dermatologist informed me that prognosis was very favorable. I have been taking treatments now for two months, and I feel that I can honestly say that my entire scalp is now covered with healthy hairs. It will take a year of consistent treatment to bring hair back, but what I want to emphasize about growing hair is that the quickest and shortest route for ascertaining whether or not you can bring hair back is to stay away from quacks and get in touch with a bona fide medical dermatologist who has a reputation for honesty and who stands high in his profession. Invariably I believe hair can be restored, if roots are not dead and person reasonably young.

JOSEPH LIEBERMAN,
Philadelphia, Pa.

(The points which you bring out in your communication are practically the same as

IN JULY "AMAZING STORIES"

THE BOOK OF WORLDS, by Miles J. Breuer, M.D. This is the third in a series of three stories which Dr. Breuer wrote, according to his own statement, "largely because I didn't like Mr. Olsen's treatment of the subject of the fourth dimension." "The Book of Worlds" easily stands up on its own merit, but the author's statement only increases its interest and should furnish much material for lively discussion.

THE SPACE HERMIT, by E. Edsel Newton. Aviation seems to have gripped the imagination of the populace now, just as radio did a few years ago. "The Space Hermit" is more than a mere fantastic aviation story, though. It suggests new scientific theories about the outer air, is cleverly written and furnishes much food for thought—and perhaps for experimentation.

THE SUPERPERFECT BRIDE, by Bob Olsen. It is some time now since we heard from Mr. Olsen, and we rather wondered why. When we received this story, however, our question was answered. He had been hatching a new idea, and we are glad we waited patiently. It is a splendid biological fantasy—with much of which you may not agree. We want your ideas on the subject.

FUTILITY, by Captain S. P. Meek, U. S. A. The story does not deal with nearly as hopeless a subject as the title suggests. Captain Meek has devised an entirely new method of looking into the future. For him it is a purely mathematical problem and he invents a machine to help. The ingeniousness and simplicity of both the story and the invention are most surprising. Certainly his is a much better method than traveling into the future.

Also, THE FLYING FOOL, by David H. Keller, M.D., written in his own individual style, so well known to and liked by our readers; and the concluding chapters of THE DESERT OF ICE, by Jules Verne, which is a sequel to THE ENGLISH AT THE NORTH POLE, both being exceedingly opportune in view of the trip to the North Pole which Sir Wilkins contemplates starting in June.

Readers Think

Questions and Discussions of General Scientific Interest to All

those outlined in a recent issue of this publication, containing facts on alopecia. One cannot possibly grow hair on a billiard ball, and some heads stand just as much chance for the growth of hair as does the billiard ball.—EDITOR.)

Shall Science Ever Give a Blind Man Sight?

Editor, SCIENCE AND INVENTION:

It has long been known that light, the carrier of images, is a phenomenon of ether waves.

Some have thought and still think the corpuscular theory correct. Some think light has both these properties. Considering that the human body does not react to electrical inductance, how does light carry these images over the optic nerve, to the mind? How is the mind capable of receiving them?

In what way does such a great piece of human mechanism, the eye, assist in receiving images? Is the optic nerve of a blind man dead, and no longer can be made to conduct images? How about the optic nerve of a man with one eye blind? Is the part of the brain constituting the receiving and interpreting apparatus of images forever dead in a blind person?

Can we, by some mechanical or electrical means, ever be able to pass these images through some medium to this part of the brain, where a blind man may be able to see with mechanical eyes?

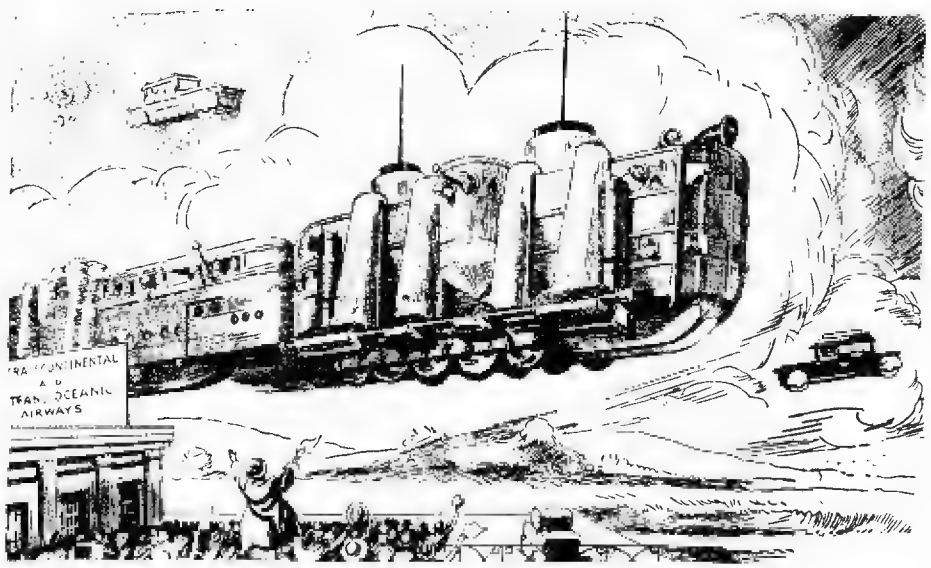
It looks as though television and radio might some day be the means of allowing a blind person to see with mechanical eyes.

W. C. GILL,
Earlsboro, Okla.

(The questions which you bring up are very interesting and have been subjects of conjecture for many years. It is not definitely known whether the image picked up by the retina of the eye is transmitted to the visional center of the brain by electrical conduction or whether it is transmitted by a photo or photo-chemical means. There seems to be a leaning toward the electrical idea, yet stimulation of the nerve centers does not give rise to vision, nor does the individual interpret such impulses as sight.

You cannot say that a nerve of a dead person is dead, no more so than the muscles of a dead person are dead. Even after death both nerves and muscles can be stimulated, but such stimulation causes no voluntary reaction on the part of the individual to whom they belonged. In other words, if food is placed before a dead person, he does not react in the same manner as he would if he were alive. He has no voluntary control. Yet, the nerve center in the brain can be electrically stimulated and any muscle can be made to react. The muscles of the arms, for example, can be made to tighten and the arm can be apparently voluntarily flexed even in a dead person, if the nerves to the muscle are mechanically or electrically stimulated, before rigor mortis sets in.

But that portion of the brain which receives and interprets images does not act, even though the nerve itself probably conducts the impulses. Whether or not that portion is dead in a dead person is something which scientists are making efforts to determine by careful laboratory tests.



A gravitation nullifier may be used in future air traffic.

If one can prove that the brain is not dead, then it should theoretically be possible to transplant a portion of the brain from one individual to another. Yet there are so many fibres from nerves that will have to be correctly aligned that this task becomes as nearly impossible as it would be to sever a telephone cable containing two or three thousand lines, and then by merely touching the two portions together to make perfect contact with each and every one of the lines and produce results.

In the lower animals, eyes and even heads have been transplanted. In man, such developments as a whole have not as yet taken place, although portions of the eye have been successfully transplanted.

If sight is of an electrical nature and the exact frequency necessary for getting a response from the visual center of the brain is discovered, it is conceivable that some means could be devised whereby an individual would be able to see by an electrical or other eye in substitution for his normal eye. If such a system is developed, then of course nearly every blind man could see with the aid of these sight mechanisms. This is based on the assumption that the visual centers of the brain are in good order. That is one of the things which the future may decide.—EDITOR.)

Gyroscopic Flying

Editor, SCIENCE AND INVENTION:

I am enclosing an article about a Seattle scientist's prediction, and believe such a machine is practical, and will be in use in about twenty years.

Kindly inform me if such a dream is scientifically possible, and will come to pass in time?

JAMES E. SMITH,
Washington, D. C.

(While we do not doubt that at some future date we will be able to fly without the aid of wings, and without propellers, it is very doubtful if the gyroscope or gyroscopic principle will be the basis of such a carrier. Many attempts have been made to develop an abundance of power through the gyroscopic principle, but such power is not present. It requires a certain amount of energy to set the wheel in motion, and the wheel cannot possibly develop any more energy than is put into it. This is as true of the gyroscope as of various other mechanisms.

Perhaps by properly charging an airplane body with a source of high potential electricity at very high frequencies, a counter-gravitational force could be set up which would permit the body to become extremely light. It is conceivable that such an action might take place. Experimentally, it has already been done by a professor at the University of Iowa, who charged small silver balls with a static machine and these balls remained afloat in the air in spite of the gravitational pull against them.

It is also possible that one might in the future disintegrate the atom and atomic energy could then repel the machine from the ground, as well as drive it through the air at unprecedented speeds. All of these subjects are within the scope of our imagination, and what man imagines he may ultimately accomplish. Whether he will do so in this generation or not is, of course, quite uncertain.—EDITOR.

Thought Transference

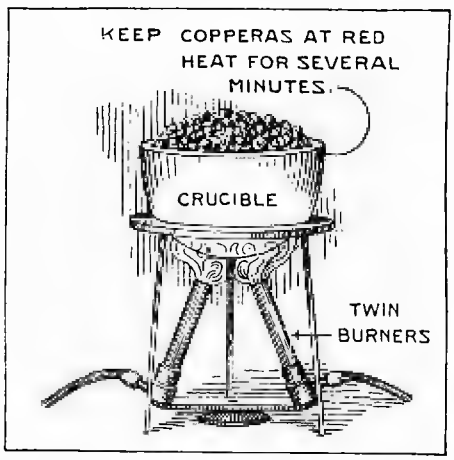
Editor, SCIENCE AND INVENTION:

Regarding the experiments on thought transference by Von Ardenne which you recently published, I believe a more elementary experiment might have had better success. For instance: All musicians have a mental expression of pitch which is com-

(*Continued on page* 283)

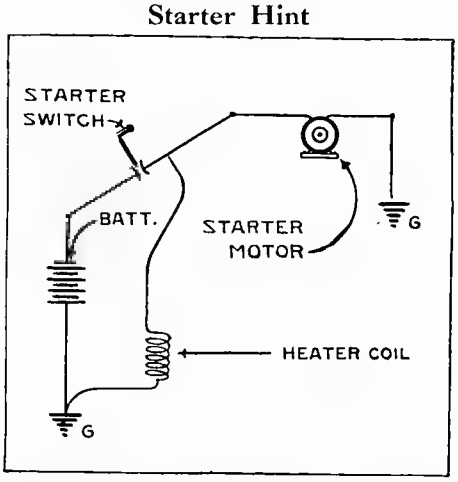
WRINKLES, RECIPES *and* FORMULAS

Optician's Rouge



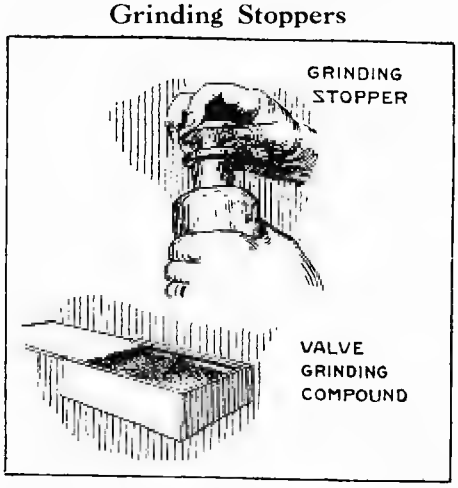
Optician's rouge can be made by placing iron sulphate in a crucible and heating it to redness. It should remain at a high temperature for several minutes. A Bunsen burner or forge can be used for heating.—L. M. Shumaker.

Starter Hint



Electric manifold heaters have a disadvantage in that the push button on the dash must be pressed to put them in operation. The above illustration shows a revised wiring circuit whereby the heater is put into operation when the foot is placed on the starter button.—R. R. Le Compte.

Grinding Stoppers



Valve grinding compounds sold by garages for grinding automobile valves may be used for grinding glass bottle stoppers. The coarse grade should be used. A thin coat is applied to the stopper, which is twisted first one way and then the other.—Contributor send name and address.

A Water-Color Hint

A hint of value to all water-color artists: put a dash of ordinary cooking salt in the paint water. It will be found that the salt precipitates the paint rinsed from the brush, thus obviating changing the water.—*Contributed by James P. Young.*

Razor Blade Microscopes

In the center hole of a Gillette razor blade, or of one of similar construction, place a drop of water. This is easily done by merely allowing water to flow over it. If the blade is now held about half an inch from the object to be examined, it will be found that a high degree of magnification is obtained.—*Contributed by John S. Sprague.*

Paste Tube

An efficient paste and a combination container and applicator can be made with little trouble. The container consists of a small, wide-mouth bottle, the mouth of which is covered with a double piece of gauze. An old glass salt shaker is well suited for this purpose. The container is half filled with gum arabic and a little water added. Stir this into a paste, fill the container with water and then stir again. The gauze is firmly fastened over the mouth with cord An old ointment jar should now be secured and the mouth of the paste jar placed in it. When not in use, the paste jar is set mouth downward into the receptacle mentioned.—*Contributed by Kenneth Gray.*

Sweeping Compound

Dry sawdust, 5 lbs.; paraffin oil, ¼ pint; paraffin, 1 ounce; coarse salt, 4 ounces; eucalyptus oil, 1 ounce; sea sand, 2 lbs. Warm the paraffin oil, mix with the melted paraffin, dissolve any aniline color desired, add the eucalyptus oil, saturate the sawdust with the liquid and then mix with sand.—*Contributed by E. H. Tokaijian.*

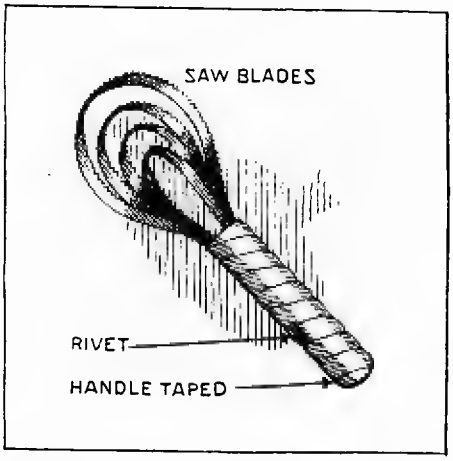
Tests for Tooth Pastes

Dissolve some of the paste in water, add 5 c.c. of dilute hydrochloric acid and drop in a few crystals of potassium iodide. If chlorates are present, iodine will be set free, giving a dark color to the solution. Tooth pastes containing soap produce a large amount of foam when shaken with water. Carbonates are present in tooth pastes and powders if the solution becomes effervescent when treated with an acid.—*Contributed by Edward H. Tokaijian.*

Tenth Divisions on Ruler

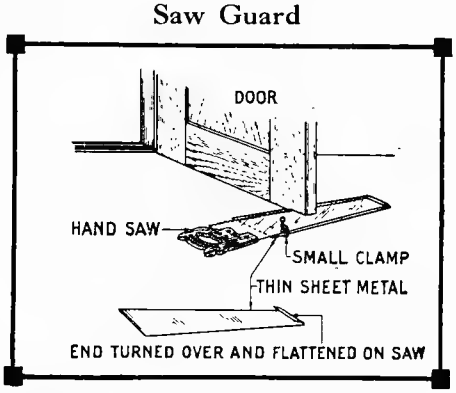
A celluloid rule can be made much more useful by having the figures and divisions of one inch scraped off with a razor blade and tenth divisions marked thereon with the sharp point of a penknife. An ordinary ruler can be treated in the same manner with figures, divisions and varnish scraped off and the tenths marked with black ink.—*Contributed by Arthur Flinner.*

Fish Scaler



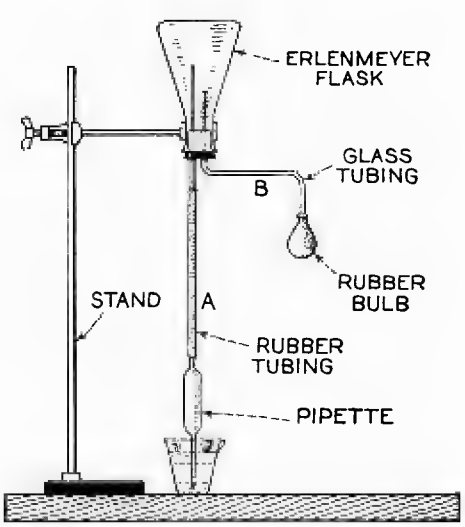
A handy scaler for fish can be made from pieces of worn-out or broken hack saw blades, as shown in the illustration. The blades are bent and fastened to a wooden handle with a rivet. The handle is then wrapped with heavy tape.—C. H. Carr.

Saw Guard

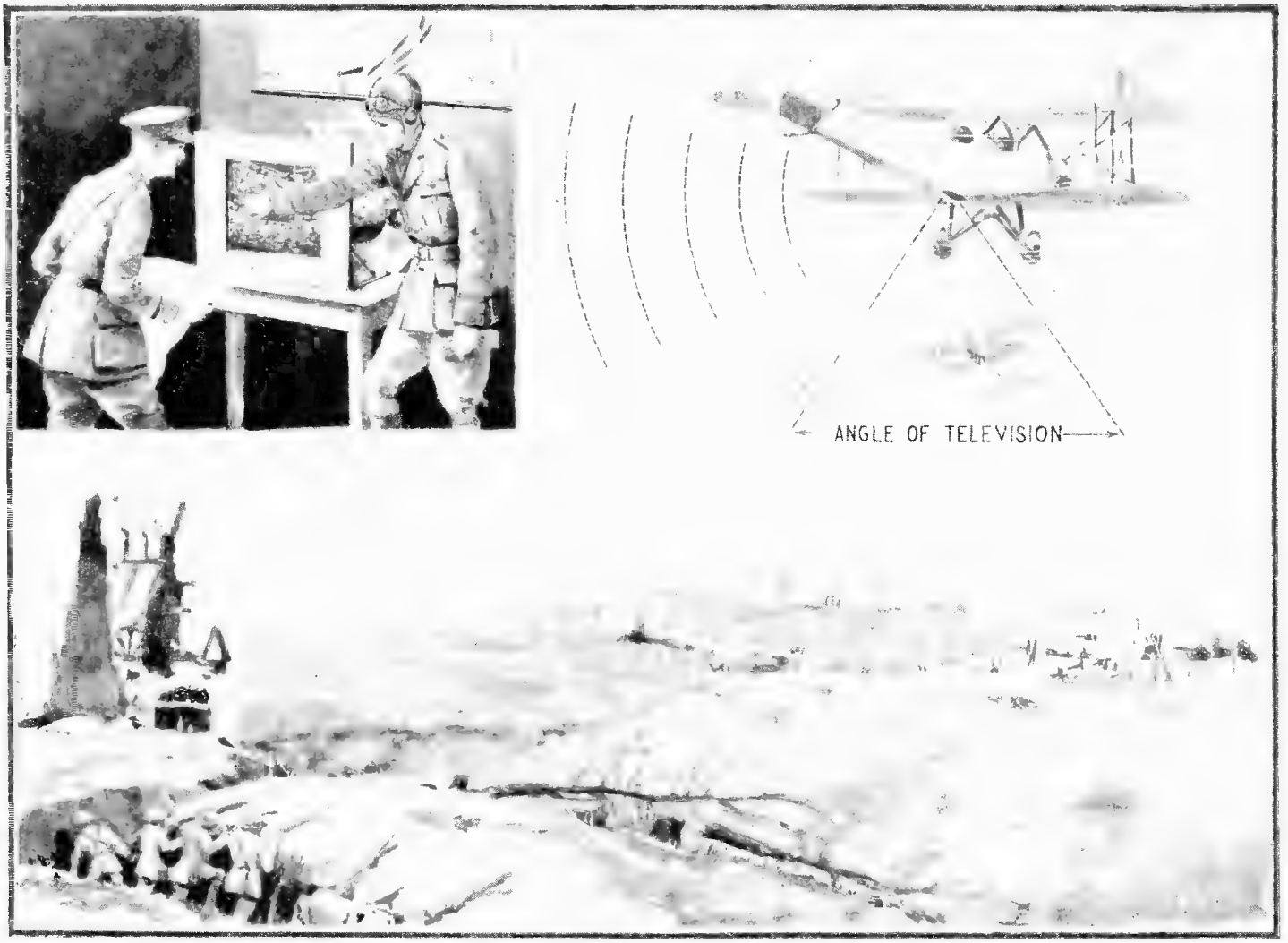


When the underside of a door must be sawed because the door sticks, the floor or sill is usually marred. A thin sheet of metal cut and bent, as shown, moving with the saw, will act as a guard and protect the floor.

Suction Filler



The above illustration shows a method for filling pipettes whereby the danger of sucking the chemicals into the mouth is eliminated. Tube A carries a length of rubber tubing and B is bent at right angles with a 60 C. C. rubber bulb at the end.—F. R. Moore.



The above drawing shows the hook-up of the Jenkins television transmitter, which reveals the secrets of the enemy.

A complete plan of enemy fortifications and disposition of troops could be obtained with the airplane eye.

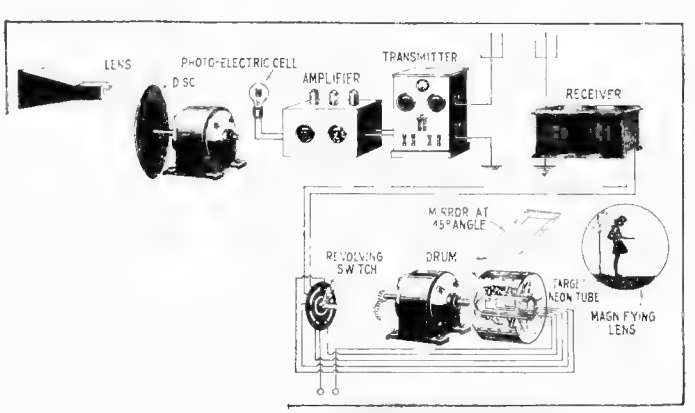
AERIAL "EYES" FOR FUTURE WARS

A RADIOVISION eye which can pry into enemy secrets miles away has been perfected by Mr. C. Francis Jenkins, well-known television inventor and experimenter. This apparatus is soon to undergo tests in a laboratory airplane of the U. S. Government. It is contemplated using a television transmitter installed in the plane for broadcasting the images of troop movements or layouts of fortifications to a ground station miles away. The first tests are expected to give a range of about 500 miles.

Use in Warfare

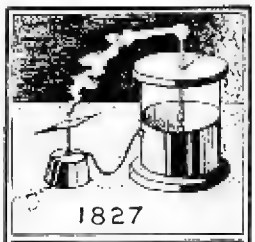
WHEN used in time of war, the airplane eye would give commanders a "moving picture" of enemy movements, and for this reason military officials will watch the tests with great interest. The panorama below the plane would be recorded by means of a lens, a scanning disc and a light, sensitive cell which would translate the light waves into electrical pulsations or vibrations. These would be used to modulate a standard aircraft radio transmitter.

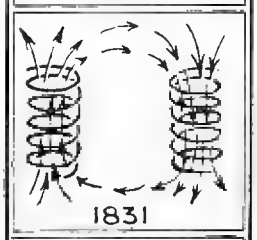
The first test will be conducted within about three weeks, and the construction of a new test station north of Washington, D. C., will soon be under way. The system used by Mr. Jenkins at the present time employs a "target" neon tube at the receiver. This is placed within a revolving drum perforated with rows of small holes, so that the light from the tube can be directed upward through these holes to a mirror set at a 45-degree angle. The reflected light waves from this mirror are directed upon a magnifying lens, so that an enlarged image is produced. A revolving switch successively connects each one of the targets or plates in the neon tube to the output of the radio receiver. Further details of this system of television transmission and reception will be found in the August, 1928, issue of RADIO NEWS.

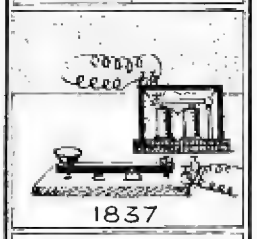


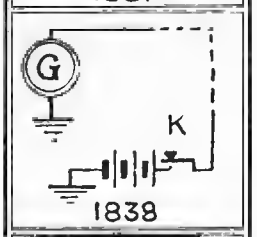
The above drawing shows the hook-up of the Jenkins television transmitter and receiver. Apparatus such as this installed in airplanes may have far-reaching effects in the next war.

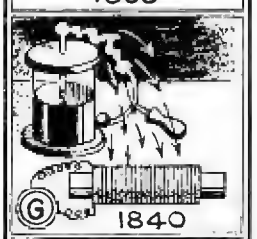
Television may prove to be a real menace in the war of the future. One can imagine the importance of a plane equipped with an "eye" such as that described here. It would be twice as deadly if the aircraft were constructed of "plass," a transparent substance recently developed, having a strength comparable to woods and metals now used in airplane construction. Great Britain, at the present time, has planes made of this substance.

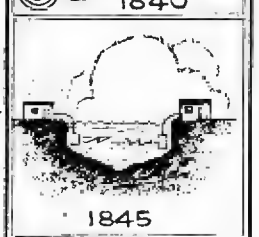


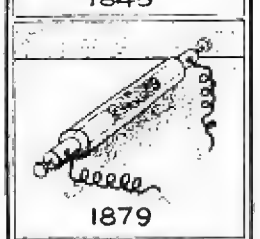


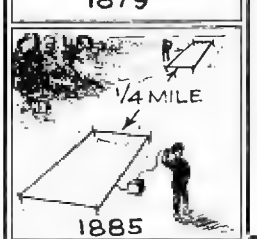


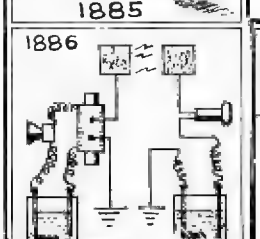












HIGH LIGHTS

A Review of the Outstanding Achieve- Make the Art of Radio What It Is Last 100 Years Have Enriched the

By PAUL L.

IN the history of radio communication certain names stand out like bright stars against the black curtain of the night. These are the names of scientists, men who have pioneered and devoted their life to research work and to the development of apparatus or instruments which would make the present-day radio programs possible and bring international commercial communication to its present heights.

In the last 100 years of radio progress there are numerous brilliant discoveries and inventions which deserve mention, and the author has endeavored to include those which he thought were most important. Obviously, individual opinions will vary.

Early Pioneers

In 1827 the Englishman, Savary, found that a steel needle could be magnetized by the discharge from a Leyden jar. The next important discovery which materially aided the progress of radio communication was made by Michael Faraday in 1831. He discovered the existence of electro-magnetic induction between two separated circuits. Faraday was one of the most brilliant experimenters that science has ever known, and to him credit is due for much that has been accomplished in electricity.

Electric Telegraph

The first patent for an electric telegraph was taken out in 1837 by Cooke and Wheatstone in London and Morse in the United States. Following closely upon this recently discovered means of communication, Karl August Steinheil, a German physicist and astronomer, discovered the use of the earth return or ground connection in the year 1838.

Early "Wireless"

JOSEPH HENRY, the noted American physicist, in 1840 first produced high frequency electric oscillations and discovered that the discharge of a condenser was oscillatory. In 1842 Morse made wireless experiments by electric conduction through water and in the next year Lindsay suggested that if it were possible to provide stations not more than twenty miles apart, all the way across the Atlantic Ocean, there would be no need for using a cable. Two years later he made experiments in transmitting messages across the river Tar by means of electricity or magnetism without submerging wires. The water was used as a conductor. In 1849 Wilkins again advanced the same suggestion for wireless telegraphy. During this year, Dr. O'Shaughnessy succeeded in transmitting signals without metallic conduction across a river 4,200 feet wide. A method of conveying electric signals without the employment of a continuous conductor was patented by Heyworth in the year 1862. Five years later James Clerk Maxwell, one of the greatest of modern physicists, read a paper before the Royal Society in London, in which he presented the theory of electromagnetism, which was to be developed more fully by him in 1873 in his great treatise on magnetism and electricity. Maxwell predicted the existence of electric waves now used in radio. In 1870 Von Bezold discovered that oscillations set up by a condenser discharge in a conductor produced interference phenomena. Two years later Highton made experiments with Morse's method.

Further Developments

HUGHES, in 1879, made an important discovery upon which depended the action of the coherer, which was later used practically by Marconi. During the next year Trowbridge found that signaling might be carried out over distances by electric conduction through the earth or water by stations not metallically connected. In 1882 Bell, using Trowbridge's method on the Potomac River, succeeded in detecting signals at a distance of 1½ miles. Professor Dolbear, in the same year, was awarded a United States patent for wireless apparatus, and made the following statement: "Electric communication, using this apparatus, might be established between points certainly more than one-half mile apart, but how much further I cannot say." The inventor, now long forgotten, actually made an approach to the method which was afterward used by Marconi in successful communication by wireless. The next year, 1883, Fitzgerald suggested a method of producing electromagnetic waves in space by the discharge of a static conductor.

Radio Telegraphy

THOMAS A. EDISON, in 1885, assisted by Gillilaud, Phelps and Smith, worked out a system of communication between railway stations and moving trains by means of induction. Edison took out only one patent on long-distance telegraphy without wires. During the same year Preece made experiments in England and showed that in two completely insulated circuits of square form, each side being 440 yards long, placed a quarter of a mile apart, telephonic speech could be conveyed from one frame to the other by induction. The next year Dolbear received a patent on a system for establishing wireless communication by means of two insulated elevated plates.

in RADIO HISTORY

ments and Inventions Which Helped to Today. Pioneering Scientists in the History of Wireless Communication

WELKER

There is no evidence that the method proposed could effect the transmission of signals between stations separated by any great distance. In the year 1887 Heinrich Hertz, the German physicist, showed that electro-magnetic waves are in complete accordance with the waves of heat and light. He founded the theory upon which all radio signaling devices are based. In this same year Heaviside established communication by telephonic speech between the surface of the earth and the subterranean galleries of the Broomhill mines, 350 feet deep, by laying above the ground and below the ground two complete metallic circuits, each parallel to the other and about two and one-quarter miles in length. In 1889 Thompson suggested that electric waves would be valuable for transmitting signals through fog, and two years later Trowbridge suggested that communication could be established by means of magnetic induction between two separate and completely insulated circuits.

A Long Step Forward

SIR WILLIAM HENRY PREECE, the distinguished British electrical and telegraphic engineer, in 1892 invented a method which united both conduction and induction as the means of affecting one circuit by the current flowing in the other. In this way communication was established between two points on the Bristol Channel and at Lochness in Scotland. A device for detecting electro-magnetic waves, known as the coherer, was invented by Branly in the same year and contributed greatly to the advancement of the art of wireless communication. In 1894 and 1895 Rathenau and Smith respectively conducted experiments in communication by conduction. In the latter year Marconi concluded that Hertzian waves could be used for telegraphing without wires.

Marconi's Experiments

MARCONI made an application for the first British patent on wireless telegraphy in 1896. He conducted successful experiments in communication over a distance of one and three-quarter miles. In the same year the first demonstration of directional wireless communication, known now as the beam radio, using reflectors, was given in England. Experiments were also conducted to determine the relative speed of the propagation of light waves and electric vibrations which actuated a receiver at a distance of one and one-half miles between reflectors.

In March, 1897, Marconi successfully established communication over a distance of four miles, and in the same month balloons were first used for the suspension of radio antennas.

In the month of July, in the same year, Marconi established communication between the shore and a ship at sea, 10 miles distant. In September and October apparatus for radio communication was erected at Bath, England, and signals were received from Salisbury, 34 miles away. On November 1st Marconi erected a station on the Isle of Wight and communicated over a distance of 14½ miles. On December 6th signals were transmitted over a distance of 18 miles from ship to shore, and on the next day the first floating wireless station was completed. In 1898 the first paid radiogram was transmitted from the Isle of Wight station, and in the following year a French gunboat and two American battleships were equipped with radio apparatus. In July of the same year three British warships, equipped with Marconi apparatus, interchanged messages over a distance of 84 land miles.

Commercial Stations

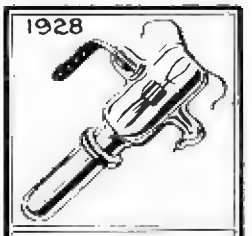
ON February 18, 1900, the first German commercial land station was opened and on the 28th of that month the first German liner fitted with radio apparatus communicated with this land station over a distance of 60 miles. In November, the first Belgian land station was completed.

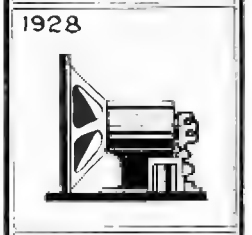
In the year 1901 radio was used to report many marine accidents, and numerous lives were saved by the arrival of ships directed by radio to the scene of the accident.

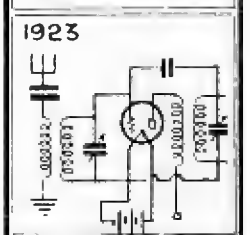
On March 1st of the same year a public wireless telegraph service was established between the five principal islands of the Hawaiian group, and on October 15th the first aerials were erected for experiments between Newfoundland and Poldhu, in England.

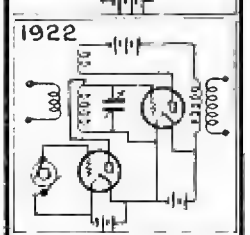
Transatlantic Telegraphy

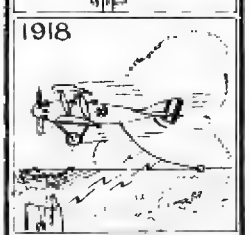
ON December 12, 1901, the letter S was received by Marconi from Poldhu, England, at St. John's, Newfoundland, a distance of about 1,800 miles. In the same year Professor Reginald A. Fessenden applied for a United States patent on improvements in wireless transmission apparatus employed for the reproduction of speech or other audible signals. It is interesting to note that in connection with this apparatus he contemplated using an alternating current generator having a frequency of 50,000 cycles per second. Professor Fessenden was granted a number of United States patents dealing with radio telegraphy between the years 1890 and 1905. (*Continued on page* 284)

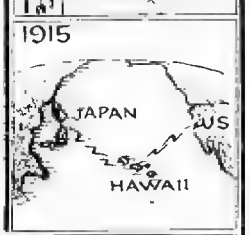


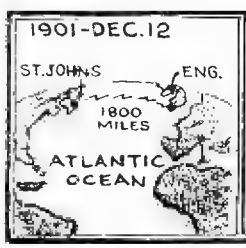


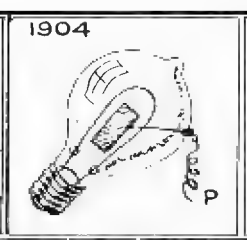


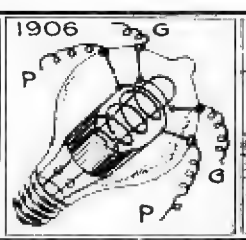


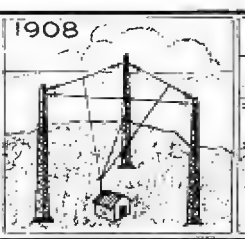


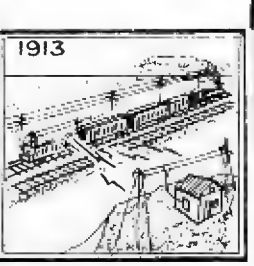


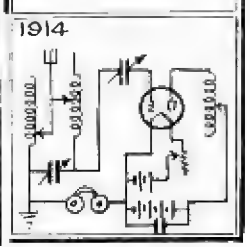




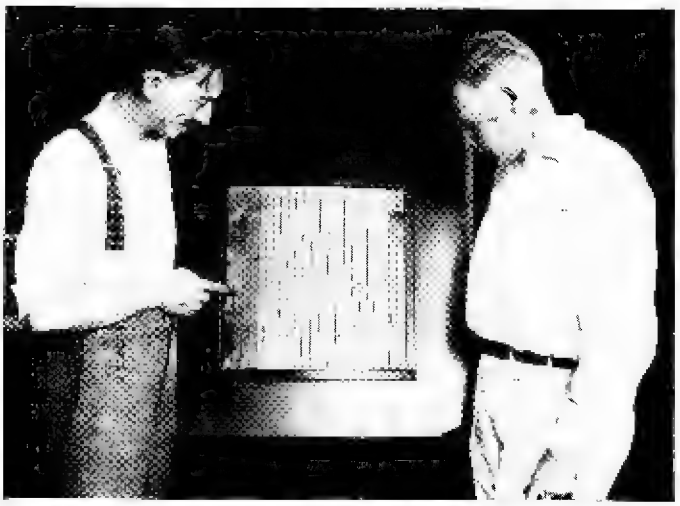








Condenser Reproducer Is Latest Development in Radio



Above is a photograph of the new condenser speaker with the inventor pictured at the left. The new speaker is approximately one-eighth inch thick and consists of two metallic plates separated by a substance called Kylite.

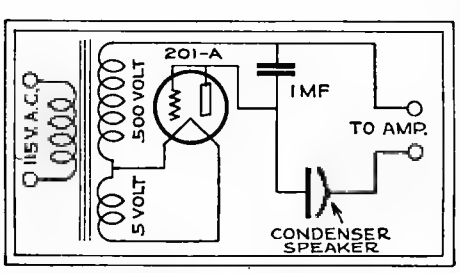
Metallic Plate Speaker Operates on "Condenser Principle" and Gives Surprising Response Over the Entire Audible Frequency Range

An Electrostatic Loud Speaker

THE first electrostatic or condenser speaker in this country to be made available to the radio public has been announced by the Newcombe-Hawley laboratories, of the United Reproducers Corp., and is the invention of Mr. Colin Kyle.

Metallic Plates

THE speaker consists of two metallic plates separated by a dielectric. The surfaces of the plates are charged or polarized with a voltage of about 450 volts and a 201-A type tube can be used for rectification in the biasing unit as shown. The polarizing device is a part of the complete speaker which makes the unit adaptable to any radio receiver regardless of the type of tubes used. The design of the plates depends to some extent upon the biasing voltage and upon the frequency response desired. The dielectric diaphragm vibrates between the plates and to insure that the diaphragm remains in close contact with the crests or corrugations, the plate is made slightly convex toward the diaphragm. The back plate is perforated to permit free passage of the air waves between it and the diaphragm. The plate is fairly stiff and is made of steel or aluminum.



The above schematic diagram shows how the condenser speaker is connected in the circuit of the biasing unit. An ordinary 201-A type tube with grid and plate connected is used as the rectifier.

The Diaphragm

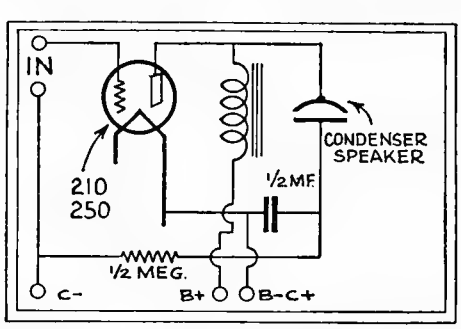
IN order to obtain a large output, it is necessary that the diaphragm be as thin as possible and yet have a high dielectric strength. The material now used is a special composition called Kylite and is about .005 inch thick and has a dielectric strength of over 2000 volts, insuring a good margin of safety. The front of the diaphragm is coated with metal. Beaten leaf is perhaps the most satisfactory material, but a sprayed metal coating is used.

Biasing Potential

THE force on the diaphragm, at any frequency, is proportional to the product of the biasing potential and the alternating voltage input. The energy output with constant input is therefore proportional to the square of the biasing voltage. This, however, is only true within certain limits, for if the biasing voltage is raised too high, the diaphragm is drawn tightly against the back plate and placed under considerable tension. A decrease in efficiency would then result especially at the lower frequencies. With the units constructed at present, a biasing voltage of 500 to 600 volts is the maximum that should be used. The circuit of the biasing unit which is used with the speaker is illustrated here. As shown, his unit is only operative when connected to an output device giving a closed d.c. path for the passage of the biasing charge. The simplest connection possible employing no auxiliary apparatus at all is illustrated below. If the connection to C— is used, the impedance between C— and C+ should be small. Power packs can be adapted for furnishing the biasing voltage, if desired.

Design

THE design and shape of the condenser loud speaker may take the form of a tapestry hanging, a fireplace shield, or a screen. Its thinness makes it adaptable to many unique designs. Since it is only ⅛ in. thick, smaller consoles can be used and the front panels of the radio sets of the future may incorporate a condenser reproducer, so that there need be no evidence of a loudspeaker. The condenser speaker requires less additional baffle than a small area cone, because its own area acts as a partial baffle. A baffle which adds a margin of about 10 inches around the edge of the reproducer has been found to be entirely satisfactory even for the lowest frequencies.



The simplest manner in which to use the electrostatic speaker is shown above. No auxiliary apparatus is needed.

The photograph at the left shows the specially equipped plane used in the tests, and at the right are the two pilots who conducted the test in which telephone messages were exchanged between the plane and the ground.

Plane-to-Ground 'Phone Service

A NEWLY developed system recently tested at Hadley Field, New Jersey, enables airplane pilots to converse with persons on the ground. A specially equipped plane, which is shown in the photograph, was used during the tests whereby conversations were held through an ordinary house telephone. The receiving antenna is a straight rod placed on top of the plane, while the wind-driven generator is astrut the wing. The transmitting antenna is a trailing wire, and the transmitting generator is placed above the airplane motor.

Mr. W. C. Rinus and D. K. Martin are shown seated in an airplane that has been equipped to send and receive messages. Conversations between the plane and ground can be held up to heights of a half mile, and this distance will undoubtedly be increased within the year. In the very near future, after further experiments and tests have been made, it is expected that anyone can communicate with flying craft through the medium of the ordinary house telephone at no great expense. The effects of this achievement are far reaching and will undoubtedly further increase commercial passenger transportation by plane.

At the left is a photograph of the front view of the Radiomaton receiver, which is the main receiver of the coin-in-the-slot system. The receiving set is capable of operating 300 pairs of headphones simultaneously.

Slot Machine Radio

A COIN-IN-THE-SLOT radio receiver for guests has recently been installed in many hotels in England. One penny allows for five minutes of operation. The main receiving set is shown in the photograph, and the output of this is connected to 300 pairs of headphones, which is the maximum number that can be actuated simultaneously by the set. The receiver is known as the Radiomaton and is shown here in one of the larger hotel lobbies where a loud speaker is used to provide the entertainment. Guests can lounge in their rooms with excellent entertainment available and at a small cost.

A number of hotels in this country have also adopted a similar system, but entertainment is provided free of charge, and the listener can choose between two or three programs by simply operating a small switch. Radio programs or music from the hotel orchestra are brought to the guest rooms.

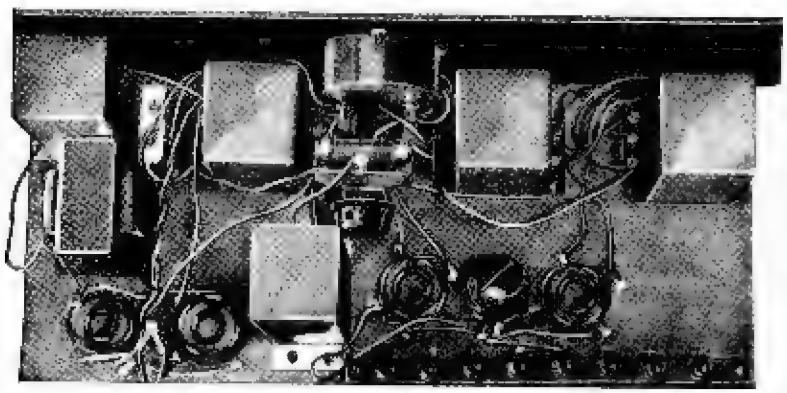
New Loud Speaker

MR. E. L. RICE, of Washington, has invented a new radio loud speaker which he claims covers the entire scale of voice and musical frequencies, reproducing them without distortion. The reproducer consists of a stack of laminated diaphragms of varying sizes which are attached to the drive rod of an ordinary magnetic cone unit.

The photograph shows the inventor with one of the piles of special diaphragms at the left. In the center is one of the completed speakers and at the right is a combined laminated diaphragm and ordinary cone reproducer. Due to the fact that the diaphragms are of varying sizes, the smaller ones being adjacent to the unit and the larger ones placed at the outer edge, it is stated that excellent response throughout the entire audio range is assured.

The photograph shows Mr. Rice and his loud speakers using laminated diaphragms of varying sizes

Part 2 of Article Describing the Construction of an Amplifier



Tuned impedance coupled amplifier has excellent characteristics

The above photograph shows a view of the completed amplifier looking from the top. The layout of the parts is clearly visible.

A Radio-Phonograph Combination

THE construction of an electric phonograph was presented in the last issue of this magazine. No receiver was described so that the builder might include any set that he wished. An amplifier for use with both the radio set and the electric phonograph is detailed in this article and is not difficult to build.

THE quality of receiving set and electric phonograph reproduction is largely determined by the characteristics of the audio frequency amplifier. If the amplifier functions without appreciable distortion, the quality delivered will be good. The construction of a double impedance amplifier having an excellent frequency characteristic curve will be outlined in this article.

Tuned Impedances

THE tuned double impedance units employed in the amplifier are designed to give greatly increased amplifications between frequencies of 40 to 200 cycles. When used in conjunction with a dynamic speaker, the low notes roll forth with surprising volume. The increased amplification is obtained by tuning each impedance unit with fixed condensers which are placed inside the case of the impedance coupling unit.

No "Motor-Boating"

AN important feature is the automatic elimination of motor-boating so that the amplifier can be used with any good B eliminator. Motor-boating is usually a low frequency beat of about 30 cycles and as the amplifier has a sharp cut-off at the low frequency end, the chances of motor-boating are very slight. The amplifier also has the capacity of handling a large amount of signal energy without distortion. Some resistance and impedance-coupled amplifiers will not reproduce as well as transformer-coupled audio systems, because they are easily overloaded. This often happens even though their frequency characteristics are superior to the transformer-coupled amplifier in some instances.

Construction

THE amplifier should be built as a separate unit so that it can be attached to any receiving set and to the output of the phonograph pick-up when desired. This audio system will work equally well with any receiver. The three tuned double impedance units and the output transformer are mounted on the baseboard as are the sockets. A binding post strip is placed at the rear of the baseboard. The layout of parts can be seen in the photograph. The A.C. filament transformer is mounted at one end and supplies both the 2½ volts and 7½ volts alternating current for the 227 and 250 tubes. The baseboard can be of wood, hard rubber or bakelite and may be attached to the front panel by means of sub-panel brackets. A switch and milliammeter are mounted on the front panel and connected in the circuit as shown. The resistance R is rated at 10 ohms and R1 should be a wire-wound variable resistor of about 0 to 1000 ohms. R2 is a 20-ohm resistor.

In order to obtain an electrical balance in the filament transformer circuit, a center tap resistor is used across the secondary or filament winding. The center tap of the resistor which is wired across the 2½ volt winding is connected to B plus 45 volts and the resistor employed across the 7½ volt winding is connected to one side of the 1000 ohm resistor designed as R1. 135 volts is used on the plates of the two 227 tubes and 300 to 425 volts on the plates of the two 250s. An output impedance and a condenser protect the loudspeaker winding when an ordinary reproducer is used. However, when a dynamic speaker is employed, the output impedance is not necessary, as these last mentioned speakers are equipped with a special coupling transformer, incorporated in the speaker at the factory.

Wiring the Amplifier

THE actual time taken to wire the amplifier after all parts have been mounted should not exceed an hour. The layout is such that all connections are short. If a sub-panel is used, the wiring will be somewhat more complicated, but a neater appearance will result. All leads carrying A.C. voltages should be twisted together. The correct C bias can be determined by watching the milliammeter in the output plate circuit. No deflection of the needle should be noted when the bias is correct. The variable resistor R1 makes it possible to change the C bias easily.

The layout and size can, of course, be changed to suit the builders' requirements. Incidentally, the amplifier is excellent for the magnification of television signals.

Installation

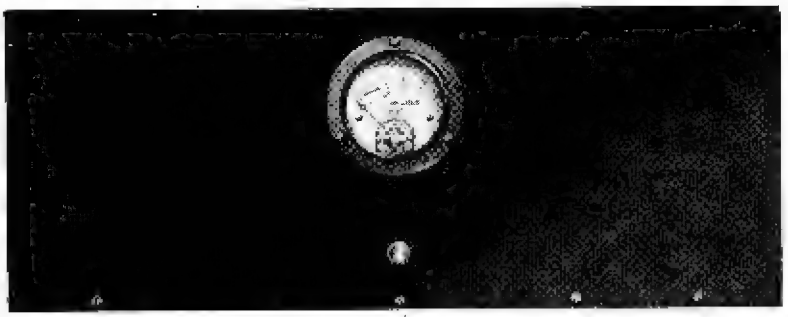
THE diagram clearly shows the connections which must be made from the input of the amplifier to the radio receiver. The two leads from the phonograph pick-up are connected to P and B plus 45 posts on the first double impedance unit. The switch on the phonograph turn-table provides for changing from radio reception to phonograph reproduction. The B supply can be obtained from your present eliminator if sufficient voltage is delivered for the operation of the two 250 tubes which are parallel in the output stage.

Distortionless Power Output

A CONSIDERABLE volume or power output is necessary for good reproduction. The quality obtainable from any amplifier depends upon the frequency characteristic and

Names of manufacturers supplied upon request

to Be Used in the Combination Radio-Phonograph



A milliammeter and a switch are mounted upon the front panel. The neat appearance of the amplifier is apparent in this view.

amplitude characteristic. Briefly, it depends upon the volume or power output which the amplifier can handle without distortion. Generally, the greater the available distortionless power output the better will be the tone quality, even though all of the available power is not used. Some amplifiers show satisfactory frequency characteristics and the amplifications of audio frequencies may be uniform, indicating that the amplifier should deliver good quality. Actually, this may not be the case and the tone quality with even a moderate amount of volume may be bad due to the inability of the amplifier to handle much volume without distortion. In other words, it has a very limited handling capacity. In the tuned double impedance amplifier, the maximum available distortionless output of any tube can be realized. This is made possible by the use of impedance as grid leaks and by the elimination of magnetic coupling between the stages. The impedance grid leaks prevent the possibility of tube blocking and the absence of magnetic coupling eliminates distortion of the wave form of the signals. The normal operation potential of the grid can be adjusted to the center of the straight portion of the characteristic curve of the tube. The maximum voltage amplification of each tube is utilized. If the builder wishes, he may buy a phonograph amplifier complete from the manufacturers. There are several good amplifiers of this type now on the market.

A TUNED AUDIO AMPLIFIER

THE quality of any receiving set and also that of phonograph reproduction is dependent to a great extent upon the audio amplifier. The outfit shown here will reproduce frequencies as low as 40 cycles. The frequency characteristic curve is exceptionally good.

General Considerations

THE receiver used in the combination radio-phonograph need not have more than 2 or 3 tubes, one or two stages of radio frequency being sufficient. When used with the tuned double impedance amplifier and a dynamic speaker, the receiver will furnish a quality of reproduction which would be hard to equal at any time. Electrically cut and reproduced phonograph records furnish excellent programs when static is troublesome or when the listener does not care to use the radio receiver.

Operation

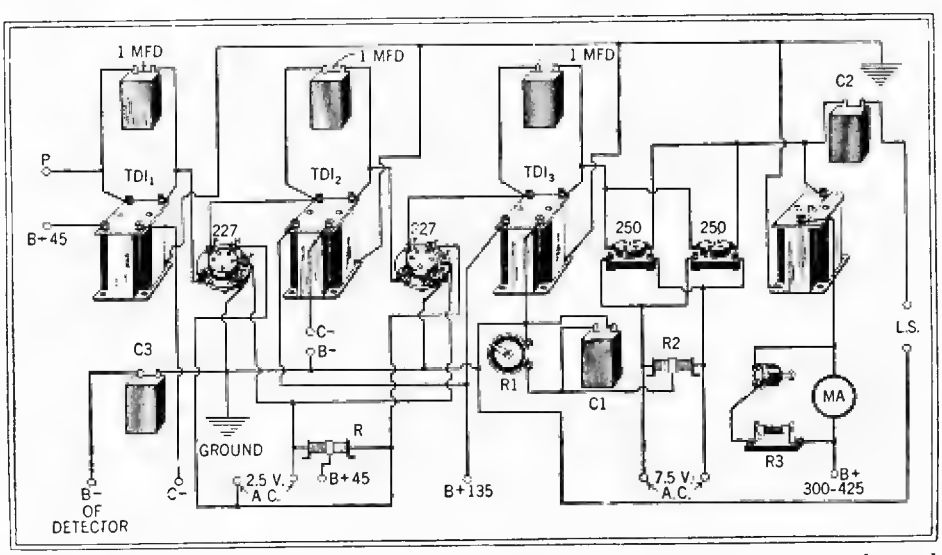
FROM the wiring diagram it will be seen that the amplifier is similar to the double impedance coupled types, except for the fact that the impedance units are tuned by means of fixed condensers placed within the case. These condensers enable the amplifier to be tuned so that an excellent characteristic curve results. With an amplifier of this kind it is possible to realize the maximum voltage amplification of the tubes employed. The use of impedances as grid leaks precludes any possibility of tube blocking or rectification, which are common causes of distortion in ordinary impedance and resistance coupled amplifiers. The power output of these latter amplifiers is curtailed by blocking and rectification, which materially affects the handling capacity. That is, unless the coupling condensers used are of low value, which, however, will affect the frequency characteristics and reduce the amplification at low frequencies. The power output of a transformer coupled amplifier is limited by the fact that it is necessary to prevent the generation of grid currents. The normal operating potential of the grid must be held at a sufficiently negative value to prevent the signal variations of grid potential from causing the grid to become positive in respect to the filament. Grid currents are generated if the grid becomes positive, the secondary of the transformer is partially shorted and the external impedance of the preceding tube is reduced. The voltage across the secondary of the transformer is reduced and distortion results.

The power output of the tuned double impedance coupled amplifier is not limited by any of the above-mentioned effects.

By using two 250 tubes in parallel it is possible to obtain twice the power output of one 250 with the input voltage necessary to operate a single tube of this type.

The power output of a tube is proportional to the square of the input voltage. The characteristics of the 250 tube shows that in order to obtain the 4,650 milliwatt output with maximum plate voltage, a signal input voltage of 58.8 volts r.m.s. (0.7 times the grid bias voltage) is necessary. Sufficient voltage amplification must be used between the detector and the grid of the 250 tube if its greatest power output is to be realized. The amplifier described here insures the necessary voltage gain. The 250 tube is not particularly adapted for use in a push-pull stage because of the high signal voltage necessary to operate it at anywhere near its maximum output.

The bias for the tube should be obtained by the drop across a resistor in series with the B— return, and it will be found that this compensates for changes in plate voltage, which may occur as a result of line voltage variation.

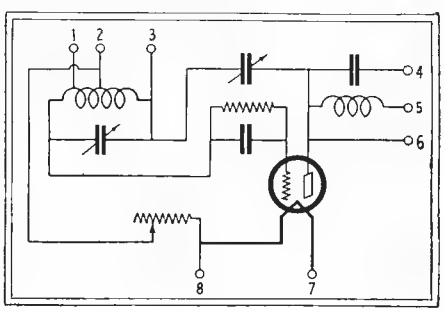


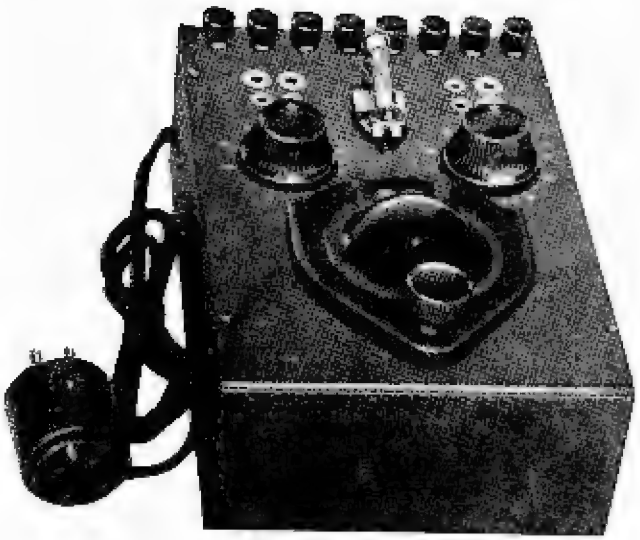
A picture diagram showing the hook-up of parts appears above. Two 227 type tubes and two 250s are used. TDI-1, TDI-2 and TDI-3 are the tuned doubled impedance units. C1 has a capacity of one mfd., C2 two to four mfd. and C3 has a capacity of one mfd.

New Radio Devices

A Versatile Device

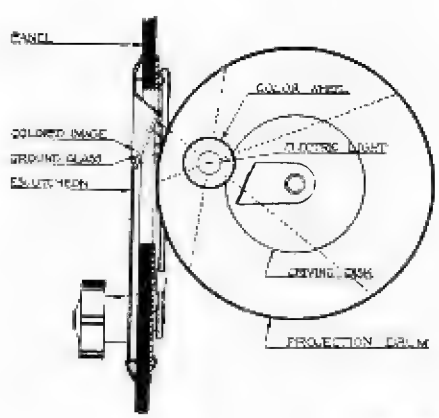
A CLEVELAND manufacturer has recently announced what he terms a "multi-unit." It has a remarkably wide range of usefulness and is adaptable to more than twenty different uses as a piece of radio apparatus. Some of the more important employments are as follows. It can be used either as a short-wave receiver, a short-wave adapter, a screen grid preamplifier, a remote control adapter, an extra stage of radio frequency amplification, a wave-trap, and an audio oscillator and the like. As may be seen in the photograph, the binding posts are arranged on the panel, making all or part of the circuit available for any of the various uses. Plug-in coils are furnished and make it possible to cover the short-wave and broadcast wave-length bands. The unit can be obtained, furnished with a 4-prong adapter plug or with a 5-prong adapter plug for use in the detector socket of an electric set. All the parts employed are of high quality and the unit undergoes rigid tests before leaving the factory.





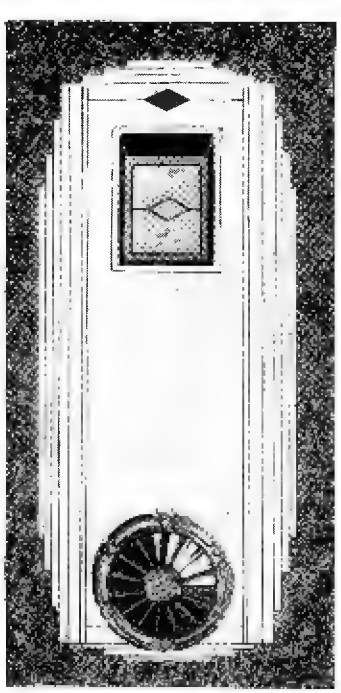
Above is a photograph of the combined unit which can be used in more than twenty different ways. At the left is the circuit diagram of the unit. By the use of plug-in coils, both short-wave and broadcast wave-lengths can be covered. The binding posts marked on the diagram are conveniently arranged on the panel.

"Rainbow Dial"



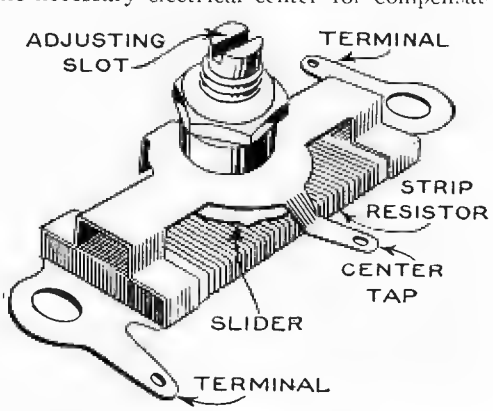
A RADICAL departure from the design of radio dials has been inaugurated by a Massachusetts manufacturer. The escutcheon plate is ultra-modern in appearance, but the outstanding feature is a rainbow effect. When the receiver is turned on, the ground glass front lights up and a single figure appears. As the dial is turned, the figure fades out and another one takes its place, only to stand out for a short time and then to disappear, giving way to a new figure. This effect is accompanied by a play of vari-colored light which acts as a background. A roll containing a translucent screen of various colors revolves around the dial light and the numbers on the drum are cast up to the ground glass in conjunction with the colors. The drawing shows the construction of the new dial.

The above drawing shows the construction of the kaleidoscope dial. At the right is a photograph showing the modern escutcheon plate.

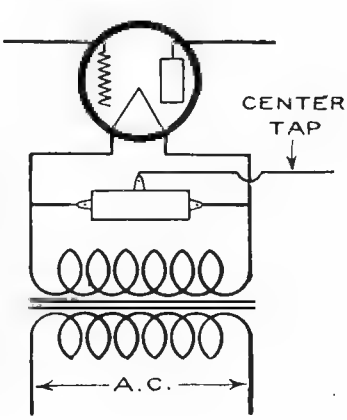


Center Tap Resistor

AN improved center tap resistor for hum control in alternating current tube circuits is now being made by a Brooklyn radio concern. This is a strip resistor provided with a movable center contact which swings over the mid-portion of the winding. Adjustment is made with a screw-driver, which engages the slot in the shaft. The device is of the one-hole mounting type and comes in resistance ranges from 6 to 500 ohms. The circuit diagram shows the resistor in use across the secondary of a filament transformer. The grid return of a tube operating on raw A. C. can be made to the center tap. The resistor provides the necessary electrical center for compensating the circuit for unbalance. The adjustment for minimum hum should be made when no signals are being received while the center tap is varied. If grid bias is secured by means of a voltage drop across a resistor suitably by-passed, one end of the resistor should be connected to the center tap, with the other end of the resistor connected to the B minus and to the grid.



The illustration at the right shows the center tap resistor for use in A. C. filament circuits. It can be adjusted by means of screw-driver, which engages the slot in the shaft. The circuit diagram shows the manner in which it is connected across the secondary of the filament transformer.



Names of manufacturers supplied upon request

A Monthly Question and Answer Department Conducted with a View Toward Helping Radio Constructors and Experimenters

RADIO ORACLE

Devoted Only to Queries of General Interest

Buckled Plates

(717) J. Kafilides, Jersey City, N. J., writes:

Q. 1. The plates on my storage battery have become warped out of shape. What is the cause of this?

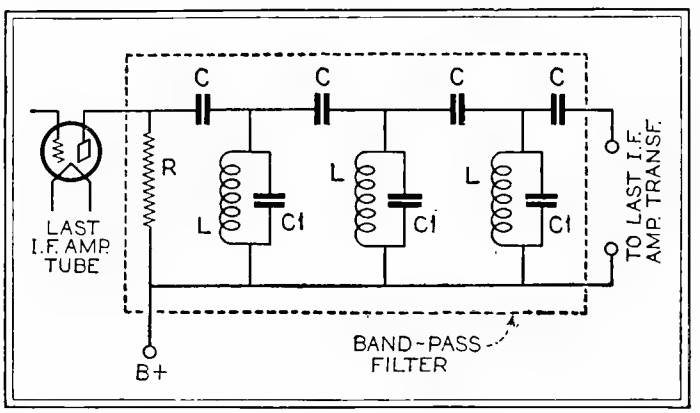
A. 1. Buckled or warped plates may be caused by too high a temperature. Lead will, of course, expand upon the action of heat, and since it has a very low elastic limit when once expanded, it will stay in that condition. Most buckled plates are caused by continued overdischarge or lack of charge. An unequally distributed chemical action at the plates will result in unequal heat distribution and will cause irregular expansion at different parts of the plate. This results in bending and buckling. Prolonged discharge causes expansion, especially if the sulphate formed is crystalline in structure. On discharge, the active material which changes to the sulphate increases in volume, and this expansion may exert pressure on the grid, causing it to bend. Hard sulphate, formed in patches, will reduce the conductivity of the plates and cause the active material which is not covered up to be worked at excessive rates, even under normal conditions. This also results in high temperatures in certain spots and unequal expansion follows. Even at low rates of discharge or charge, a battery plate which is badly sulphated may become buckled. When acid is mixed with water, heat is liberated. On charge, the acid produced at the surface of the plates mixes with the water. At excessive rates of charge the heat may be so great and irregularly distributed that the plates become buckled or warped.

Band-Pass Filter

(718) C. P. Ashton, Sturgis, Michigan, asks:

Q. 1. Will you kindly furnish me with a hook-up of a band-pass filter to be used in the i. f. amplifier of a superheterodyne and tell me how to wind the coils, in order to obtain a peak frequency of 90 kilocycles with a band-pass 10 kilocycles wide? I am now using 201-A type tubes.

A. 1. On this page you will find the hook-up of a band-pass filter and the manner in which it is connected in the receiver circuit. This filter should be used between the last intermediate amplifier tube and the second detector. It serves to couple the plate of the last intermediate amplifier tube and the primary winding of the last intermediate frequency amplifier transformer. A band 5,000 kilocycles wide is afforded on each side of the peak frequency, which, in this case, is 90 kilocycles. The first condenser, C, would normally be connected to the plate of the last intermediate frequency amplifier tube, but under such conditions it would be impossible to apply any plate voltage, since the condenser would not pass direct current; therefore, it is necessary to adopt a means for feeding the plate voltage to the amplifying tube. The resistance, R, is used for this purpose, although a choke coil could be used. If the choke coil were employed, it would be necessary to eliminate coupling between the plate choke and the inductances in the band-pass filter. The output impedance of a 201-A type is such that the capacity of C should be .000175 mf. and that of C1 .00285 mf. These capacities cannot be obtained in one condenser, and a small variation in capacity is not appreciable. By obtaining a number of small capacities and placing them in parallel or series as required, a value closely approximating that needed can be obtained. The resistance, R, should be of the non-inductive type, rated at 18,000 ohms. The coils, L, should have an inductance of 0.98 millihenry. These coils consist of 272 turns of No. 30 enameled wire wound on a form having a diameter of 1½ in. Greater selectivity will be gained by using a band-pass filter, but the effective resistance of the coils and condensers will cause losses. These, however, are usually slight, because most i. f. amplifiers have sufficient amplifying powers to permit a slight loss without changing the performance of the superheterodyne receiver.



The above schematic diagram shows the hook-up of the 90-kilocycle band-pass filter for use in superheterodyne receivers. It is connected between the last intermediate frequency amplifying tube and its transformer.

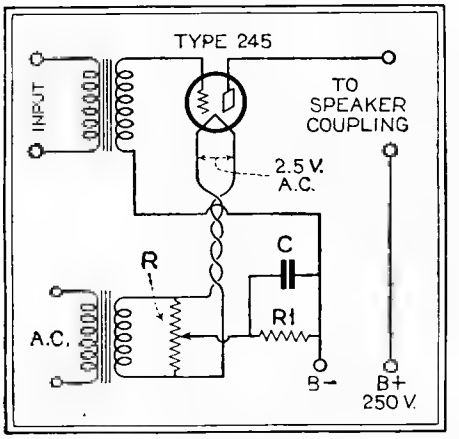
C Bias for Type 245 Tube

(719) R. H. Bowker, Greenwich, Connecticut, writes:

Q. 1. I intend to use one of the new 245 power tubes in the last stage of my power amplifier, lighting the filament from an a. c. source. I will use the maximum plate voltage of 250 and would like to know how I may secure the proper C bias.

A. 1. Doubtlessly this query will interest a large number of radio fans, as there are many who will desire to change their present equipment and substitute the new power tube for the 171 or 171-A, which is now employed in the last audio stage. The schematic diagram reproduced here shows the correct manner in which to use the new 245 type power tube. The resistor, R, which is placed across the secondary of 2.5 volt filament transformer should have a variable center tap and preferably a resistance of 40 to 60 ohms. The C bias can be secured by connecting a 1,500-ohm resistor between the grid return and the center tap of the filament transformer resistor. This is designated in the diagram as R1 and is by-passed by a condenser, C, having a capacity of 2 to 4 mfs. The grid return is connected to the B—and thus the bias is secured by the plate current drop through the resistor R1. It must be remembered that when using this method for obtaining C bias, the plate voltage available will have to be 300 volts, in order to allow 250 volts for the plate potential and 50 volts negative bias for the grid of the tube. If the plate voltage available is less than 300 volts, the bias is probably best secured by means of a C battery.

If the C bias is secured by using the drop across a resistor, it will necessarily be subtracted from the plate voltage available. The center tap of the resistor can be adjusted until a.c. hum is eliminated, and the grid and plate voltage can be correctly adjusted with a 50 milliampere milliammeter in the plate circuit, if there is any doubt as to their value. If the needle is deflected downward, the C bias should be raised or the plate voltage lowered. If the needle kicks upwards, the plate voltage should be increased or the grid bias reduced.



C bias for the new 245-type power tube may be obtained from the "B" eliminator by using the drop across a resistor R1, as illustrated above.

A Monthly Fun Page for Those Who Enjoy a Laugh

Scientific Humor

Original Jokes for Our Readers by Our Readers

THE CONNOISSEUR

VISITOR: Can you tell me the age of this prehistoric skull?

WARDEN: Hundred thousand and four years, seven months and three days.

VISITOR: How do you know it so exactly?

WARDEN: The professor who found it said it was a hundred thousand years old and he found it in Mexico four years, seven months and three days ago.—*Hubert Slouka, Czechoslovakian Correspondent.*

IS HOUSE SO SMALL?

MRS. RAPPER: Have you seen my new belt around the house?

MR. RAPPER: No, but if you get any fatter it will just about go around the house.—*Henry A. Courtney.*

IT'S FIXED ALREADY

FAN: I think that something's wrong with this thing, can you fix it?

REPAIR MAN: Can't do a thing for you, it's a fixed condenser.—*F. S. Saunders.*

SOUNDS UNSOUND

NED: Is that movie company a sound institution?

ED: Well, their pictures are.

—*Pat E. Gordon.*

THAT'S SARCASTIC

SWEET YOUNG THING: Oh, dear, I bumped my crazy bone!

HE: Well, comb the hair over it and the bump won't show.

—*Norma Jennings.*

First Prize—$3.00

FLIP-FLOP

SMART: I see where a new airplane is equipped with a kitchen.

SMARTER: Yeah, and when the cook wants to toss a pancake I guess he stands still and asks the pilot to loop the loop!—*Henry A. Courtney.*

ALL jokes published here are paid for at a rate of $1.00 each; $3.00 is paid for the best joke submitted each month.

Jokes must have a scientific strain and should be original.

Write each joke on a separate sheet of paper and add your name and address to each.

Unavailable material cannot be returned.

AT LAST THE LAST WILL LAST

An Irishman speaking to his wife who has bought him a pair of shoes:

"That's a fool thing to do—you bought me a pair of shoes which are too small! I won't be able to put them on until I've worn them a few days."—*E. Friedberger.*

NOT A HORSE

HUBBY: But I'm sure I'm right. I'll bet my ears on it.

WIFEY: Why, dear, I wouldn't go to such extreme lengths if I were you!—*Eula C. Hill.*

CAPITAL EXCUSE

WIFIE: You should always dip your soup away from you.

EFFICIENCY EXPERT: What! And lose a motion on every spoonful?—*Gleason Pease.*

CALL FOR COLD LIGHT

"Is Jane Wilkins old?"

"Old? Say when they carried in her birthday cake last time, six guests fainted with the heat."

SPORT PROGRAM

TEACHER: Tommy, what is a whirlpool?

TOMMY: A whirlpool is a merry-go-round for fishes.—*Joe Williams.*

REGISTERED MALE

SHE: How do you play hookey from your correspondence school?

HE: Oh, that's easy. I send them an empty envelope.—*George Aberer, Jr.*

WHICH SPOT

ZOO MANAGER: If the leopard gets out of the cage, shoot him on the spot.

GUARD: Yes, sir, which spot?

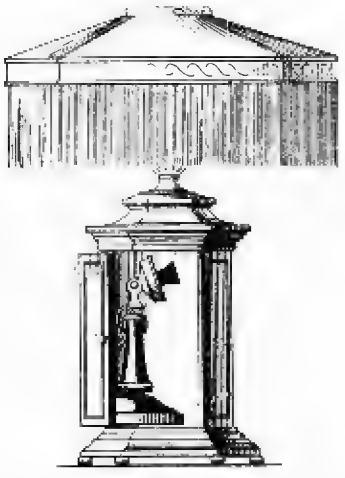
—*Harry Cole.*

SCIENTY SIMON SCIENTIST

WELL JOE, NOW THAT THEY HAVE COVERED THAT SWAMP WITH OIL THERE WON'T BE ANY MORE MOSQUITOES AROUND HERE — YOU KNOW, THOSE PESTS BREED IN STAGNANT WATER
BUT NEXT DAY
SMACK!
AND THE FOLLOWING DAY
SCIENCE LESSON NO 3.2
MOSQUITOES WILL BREED IN ANY BODY OF STAGNANT WATER IN WHICH THEY CAN LAY THEIR EGGS, AND WHICH WILL BE LEFT UNDISTURBED FOR A PERIOD OF ABOUT TWO WEEKS NOT ONLY DO THEY BREED IN SWAMPS BUT ALSO IN RAIN PUDDLES, DRAIN BARRELS OR EVEN IN AN OLD TIN CAN PARTLY FILLED WITH WATER
HELP!
WLEMKIN

LATEST PATENTS

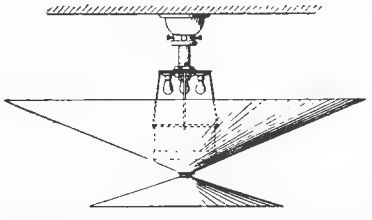
Telephone Cabinet



No. 1,702,614, issued to Thomas Francis Murphy. The invention, shown above, is a combined table lamp and telephone cabinet. The lamp is enclosed in the hollow base and a door is provided for removing the telephone. A spring winding drum holds the telephone wires, and the shelf supporting the phone may be swung outwardly when the door is opened.

Loud Speaker

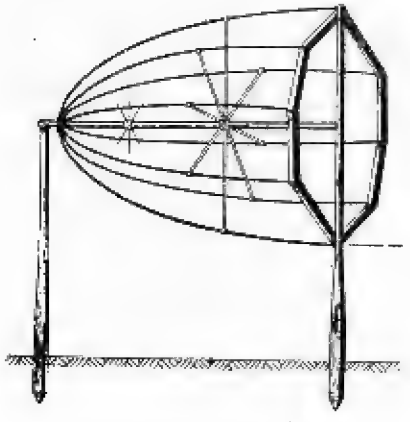
No. 1,702,399, issued to Ford E. Beidler. The object of this invention is to provide a



loud speaker in which the diaphragm is in the form of one or more cones, supported entirely by the driving rod and adapted to be mounted in a horizontal position adjacent to the ceiling.

Radio Antenna

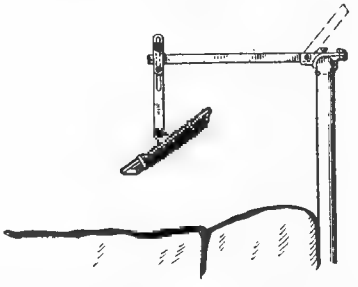
No. 1,703,870, issued to Charles S. Demarest. The antenna shown below is intended for use for transmitting an unpolarized beam of radio energy. It consists of a paraboloid of conductors, each conductor being a parabola lying within the surface of the paraboloid.



Notice to Readers:

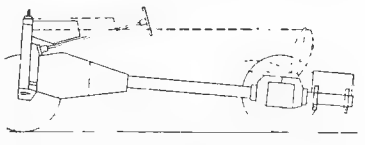
These illustrated and described devices have recently been issued patent protection but are not as yet, to our knowledge, available on the market. We regret to advise that it is impossible to supply the correct addresses of inventors of the devices to any of our readers. The only records available, and they are at the Patent Office at Washington, D. C., give only the addresses of the inventors at the time of application for a patent. Many months have elapsed since that time, and those records are necessarily inaccurate. Therefore, kindly do not request such information, as it is practically impossible to obtain up-to-date addresses.

Bedstead Book Holder



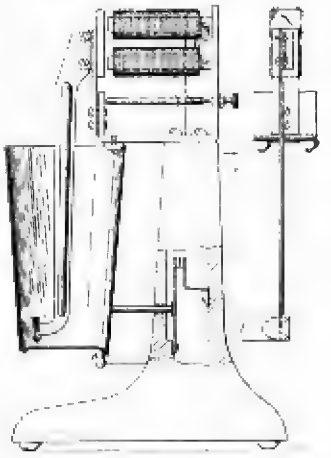
No. 1,699,853, issued to James Emile Moran. The above invention is a reading bracket which is adjustable and adapted for attachment to the bed. Means are provided for holding a book or magazine in an inverted position, so as to be visible by the person lying in bed. The book is supported by a base plate and held in place by a pair of side strips connected to the end of this plate. A swinging U-shaped member is provided for clamping the holder to the bedstead frame and a pair of jaws are provided to engage the frame. The jaws may be locked in clamping position. One of the jaws of each clamping member has a shoulder in which the adjacent arm of the U-shaped member is seated when the bracket is in use.

Motor Vehicle Chassis



No. 1,704,451, issued to Othmar Windberger. The vehicle shown above is equipped with a tubular supporting member in place of the usual underframe. The frame tube is lengthened beyond the wheel axle and forms the support for the fuel tank, spare wheel and other equipment. Such a frame in the form of a continuous tube, extending from end to end, offers may advantages. It makes it possible to locate the car body lower than hitherto, and this without the frame tube projecting into the car body. For driven axles a continuous tubular frame provides a drive in the usual manner, even when its axis is placed lower than the centers of the wheels. The driving mechanism is arranged in a casing and mounted like a saddle above a slot in the frame tube.

Magnetic Agitator



No. 1,705,162, issued to Leo J. Wahl. The drink mixer illustrated here has a rapidly oscillating element for stirring the liquid which is actuated by an electro-magnet supplied with alternating current of the customary frequency of about 60 cycles per second. Means are provided for adjusting the spacing between the electro-magnet and armature.

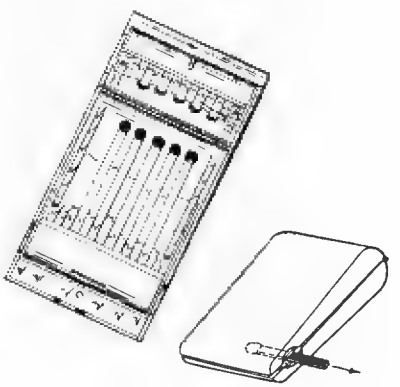
Vibrating Toothbrush

No. 1,703,642, issued to William F. Sticht. This toothbrush has a chamber in the handle with a bore leading from the chamber to

the bristle portion with a magnetic vibrator in the handle. A stem on the vibrator extends into the bore and produces rapid impacts against the end portion of the bore.

Match Box

No. 1,703,671, issued to Edward B. Hough. This invention provides a match box with a pair of covers in one or both of which may be disposed a package of book matches. The match box is so arranged that in order to light a match, when two books are used, the match may be placed with the head between the striking surfaces of the match boxes, cover closed and the match given a quick pull. The construction ensures that matches are not only easily lighted without breaking but prevents the entire box from becoming ignited.



A Monthly Scientific Question and Answer Page

The Oracle

Smokeless Powders

(2314) Chas. E. Coup, McKeesport, Pa., writes:

Q. 1. Kindly list several formulas for smokeless powders.

A. 1. We are listing below a number of the formulas requested:

No. 1

	Shot-Gun	*Rifle*
Nitrocellulose, insoluble	72.3%	72.8%
Nitrocellulose, soluble	24.5%	25.00%
Metallic nitrate	0.7%	———
Camphor and Diphenylamine	1.0%	1.0%
Moisture	1.5%	1.2%

This is a gelatinized rifle powder containing 37 grains gelatinized dense shot-gun powder.

No. 2

Solenite, a smokeless powder for rifles, consists of the following:

Nitroglycerine	34%
Nitrocotton, soluble	63%
Mineral jelly	3%

This mixture is gelatinized with acetone and made in the form of translucent short tubes of light brown color.

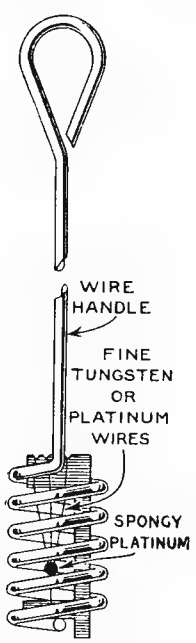
No. 3

A powder known as "smokeless diamond" which is used for shot-guns, has the following formula. This is a 33 grain bulk powder.

Nitrocellulose, insoluble	6.9%
Nitrocellulose, soluble	6.6%
Metallic nitrates	15.0%
Vaseline	2.5%
Charcoal	5.6%
Moisture	1.3%

The new Experimenter Company's smokeless for shot-guns has a 36 grain fibrous bulk powder.

Nitrocellulose, insoluble	50.00%
Nitrocellulose, soluble	25.80%
Metallic nitrates	12.0%
Nitro-hydrocarbon	7.0%
Vaseline	3.5%
Moisture	1.7%



The automatic gas lighter is illustrated above. A wire handle supports a number of fine wires to which is attached a ball of spongy platinum.

Gas Lighter

(2315) Paul Kimmerman, Omaha, Nebr., asks:

Q. 1. I have purchased an automatic gas lighter which, when held in the gas flow, becomes red and ignites the gas. I am enclosing a sketch of the lighter and would appreciate information as to how it works.

A. 1. The drawing submitted by the querist has been reproduced here with parts marked by the editor. A wire handle supports a number of fine hair-like wires of tungsten or platinum. A small ball of spongy platinum is attached to the wires. Spongy platinum is finely divided metallic platinum which has the property of absorbing large quantities of oxygen, since it possesses a large surface compared with its mass. Platinum black is of similar nature and absorbs more than 800 times its volume of oxygen, which acts as a vigorous oxidizing agent when in this condition, so that hydrogen or other inflammable gases are spontaneously ignited under its influence.

The "Oracle" is for the sole benefit of all scientific students. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be published. Rules under which questions will be answered:

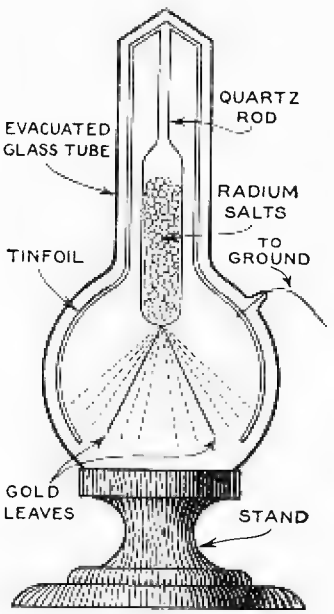
1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink; no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 50 cents is made for each question. If the questions entail considerable research work or intricate calculations, a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

Radium Clock

(2316) Lloyd A. Worthington, Brooklyn, New York, writes:

Q. 1. Will you publish a diagram of the so-called radium clock and tell me how one may be constructed?

A. 1. Lord Rayleigh is the inventor of what is known as the radium clock, which is nothing more than an electroscope in a vacuum. This is illustrated here. A glass tube or bulb is evacuated and the lower part lined with tinfoil, which is connected to the ground by a wire. There are two strips of gold leaf, which are electrified by means of the Beta rays, which are a stream of electrons shot off from the exploding radium atoms in the radium salts. These salts are contained in a small tube suspended from a quartz rod and are in metallic contact with the gold leaf strips. This clock is at present the nearest approach to perpetual motion, for in 2,000 years only one-half of the radium salts will disappear and only one-half of the remainder will be dissipated in the next 2,000 years. The atoms of radium do not explode simultaneously and in one million billion of atoms, only one atom explodes per second.



A radium clock, at present the nearest approach to perpetual motion, is shown above. In 2,000 years only one-half of the radium salts will disappear.

Cleaning Gloves

(2317) B. Plotkin, New York City, writes:

Q. 1. Can you give me a method for cleaning white gloves on a commercial scale?

A. 1. We are giving below the method for white glove cleaning, describing the process step by step.

1. Place 1 peck of maple-wood balls about 1¼ in. in diameter in an open-mesh bag 20 by 30 inches in size. Add sufficient white gloves to fill the bag loosely and tie securely.

2. Place bag or bags in a dry-cleaning machine, the cylinder of which does not exceed 30 in. in diameter. Fill the cylinder to approximately one-sixth of the diameter with new, clean naphtha, in which 1 pound of ordinary benzine soap has been dissolved. Clean for five minutes and drain. (This removes the surface soil.)

3. Fill the machine again to one-sixth of the diameter with clean naphtha, in which has been dissolved alcoholic-benzine soap in the proportions of 1 quart of soap to 50 gallons of naphtha. Clean for 15 minutes and drain.

4. Rinse for five minutes in paraffin-naphtha liquor.

5. Centrifuge for three minutes.

6. Inflate each glove and evaporate the remaining naphtha in a non-corrosive rotating cylinder by circulating warm air (not exceeding 110 deg. F. in temperature). Detailed information and approved processes for cleaning fur and leather garments will be found in Technologic Paper of the U. S. Bureau of Standards, No. 360, which can be had by sending ten cents to the Superintendent of Documents, Government Printing Office, Washington, D. C.

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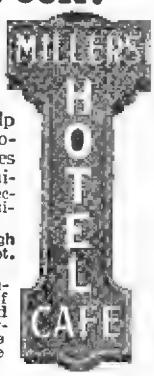

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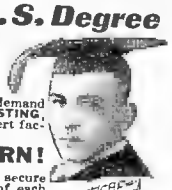

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The RISE of the SMALL INVESTOR

Wage and Salary Earners Now Playing a Major Part in the Financing of Industries Through the Purchase of Securities in Small Denominations

By ALFRED M. CADDELL

UNDER the spreading investment tree the small investor stands—with a basket to catch perennial dividend plums.

Since the war, we have been privileged to observe one of the greatest influences of modern times busily engaged in constructive work. The American wage and salary earner has been taught how to invest his surplus cash in productive security channels. He has become a partner—16,000,000 strong—in the world's greatest industries, and is providing capital funds with which to bring new enterprises into being. A colossal factor in our fast-expanding economic structure, making for individual and national prosperity, is Mr. Everyman.

When thinking of capital and the tremendous power that it implies people formerly associated it with an absolutism and a stilted dignity, that was responsible for a considerable social friction. But the idea of extending to the public the privilege of participating in enterprises affecting their industrial welfare has changed that way of thinking and suggested far-reaching economic consequences. To quote John Moody, a noted financial authority, we observe that "the independent producer is becoming a part of a larger unit; large units themselves are evolving into still larger ones; that we are witnessing right before our eyes a great nation that is sharing more and more directly as investors, employees and managers in both the ownership and development of modern corporate wealth production. This fact, it will be seen, is of the most profound significance, because it tends to unify the whole nation in interest, psychologically, with large-scale, modern methods of production and security distribution."

The World War is mainly responsible for the changes which have taken place in our investment structure. A large number of small investors had, of course, been made acquainted with the intricacies of security finance before that epochal event. Public utility corporations, especially, had learned the desirability of cementing friendly relations with the great public, which they served by inviting their customers to become partners in their enterprises. This called for investment units in small amounts, so that the average home-owner could participate in their security issues. Other corporations saw the wisdom of bringing their employees into the same relationship in order to foster self-interest in their daily tasks, thereby promoting efficiency and building up an invaluable "esprit de corps." But the great impetus to small investorship came with the war, when the government, through its appeal to patriotism, succeeded in marketing among small wage and salary earners, billions of dollars' worth of Liberty Bonds in $50 and $100 denominations, which were made easily procurable, if desired, on the installment plan; bonds representing no less than first mortgages on the United States, the wealthiest country in the world.

From that vantage point of security education, it is only natural that corporate leaders and financiers should look to this great aggregate of bond holders for capital to promote industrial expansion. All that was necessary, it seemed, was to offer their securities in small denominations on the order of one hundred thousand $10 shares for a $1,000,000 capitalization instead of ten thousand shares at $100 or a lesser

Photo Black-Steller

Mr. E. H. H. Simmons, President New York Stock Exchange, says of "The Rise of the Small Investor"

THIS article, "The Rise of the Small Investor," covers the subject of widespread investments very thoroughly and is most timely. To those of us who daily come in contact with the enormous business of investing, it is very important that a clear line of demarcation should be drawn between wise investing and irresponsible buying and selling of securities.

"From the standpoint of the actual ownership which has come over major business corporations in this country, it is very gratifying to observe the effect of this transformation on the American people. The substitution of many pillars of ownership for a few gigantic pillars of finance has made for a national health and prosperity that scarcely could have been achieved by any other means.

"From the standpoint of investments, the widespread distribution of securities has proven to be an industrial blessing. But if this development did nothing more than strengthen the confidence of people in the industries and enterprises which serve them, that indeed would be sufficient to welcome the great leveling process in security ownership that already has begun and, judging from ever-mounting success, will continue to take place."

—E. H. H. Simmons, President, New York Stock Exchange.

number of shares in larger amount. The public's willingness and ability to buy was in evidence, the desirability of wide-spread distribution was recognized on every hand, and all that remained was what may be termed the factor of choice—the proper and skillful discrimination between the worth of various offerings both from the standpoint of possible rise in value and dividend-earning power.

As any casual observer may have noticed, the growth of the investment participation since the war has been nothing short of marvelous. Prior to 1915, there were approximately 400,000 names of security holders on the books of banks and corporations throughout the United States. Today, there are upwards of 16,000,000 and the number is increasing rapidly month by month. During the last six years, new issues of stock have absorbed more than $36,000,000,000 in fixed income investments alone. Nor has this huge aggregate investment been at the expense of savings banks, life insurance or other reservoirs for savings. As evidence of this, in 1910 individual bank deposits amounted to $15,000,000,000; today they total more than $29,000,000,000 a gain of nearly one hundred percent. Life insurance companies, building and loan societies, etc., have made similar huge gains.

In all this, we may see both the cause and effect of the problem that the average man and woman with surplus funds has to contend with: What shall we do with our money? Some of the largest institutions in our industrial, banking and other representative walks of life, have answered this question by altering their financial set-up, so that the rank and file of the nation may get in step and participate in this onward march.

For instance, the shares of the Bankers Trust Company in New York, which carried a value of approximately $2,000 each, have now been split on the 10-to-1 ratio, thus making it possible for a $200 investor to become a part owner of that institution. The Irving Trust Company, a banking organization capitalized at $1,000,000,000, has made its units of ownership available in $10 par denominations. The great General Motors Corporation has undergone several capital split-ups within the last five years, and now carries the names of 82,415 stockholders on its books. Each split-up has been a direct influence in stimulating this investment demand and has been followed by an increase in the number of shareholders. Since the last split-up no less than 34,246 names have been added to this corporation's investment list.

The American Telephone and Telegraph Company has also recently increased its capitalization to a new height -$2,000,000,000 and offered very valuable rights to present stockholders to participate in the appreciation and earnings of the new issues. This company now has, as of record December 31, 1928, 423,520 shareholders, as contrasted with 281,149 in 1923, an increase of more than fifty percent, which is fairly indicative of the increased spread of corporate ownership in recent years.

About 25 percent of the stockholders of the United States Steel Corporation—49,201 to be exact—are employees of that billion-dollar enterprise, owning 132,037 shares of preferred and 661,005 shares of common stock, an average of 16⅛ shares per employee-stockholder. The books of the General Electric, the Westinghouse Electric & Manufacturing, the Woolworth chain stores and other well-known corporations in the electrical, transportation and industrial fields yield similar information, proving without a doubt that America is rapidly becoming not only a nation of workers, but of investors, who have learned how to make their money work.

The states of New York and Massachusetts have lately amended their laws permitting financial institutions to change their capitalizations.

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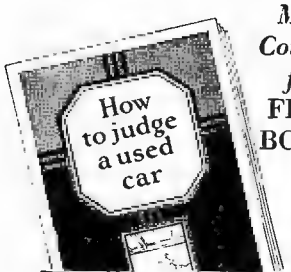

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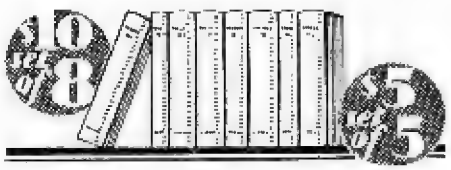

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The RISE of the SMALL INVESTOR

(*Continued from page 261*)

IN the light of this widespread distribution of stocks it is not strange to observe the tremendous activity on the stock exchanges throughout the country. Primarily, these institutions were brought into being to provide liquidation facilities for securities—a purpose that most people seem to have lost sight of, but, without which, securities would remain more or less frozen assets, which few people would care to possess. Naturally, the rapid rise in value of some stocks leads some people to sell their holdings and others to buy. The 5,000,000 and the 6,000,000 and even the 8,000,000 share days on the New York Stock Exchange only reflect the public interest in securities that has come into being through widespread distribution. People have become investment wise and have learned how to shop around for investment values to tuck away in their strong boxes until some time in the future when they may desire to sell. For instance, as of February 16, 1929, out of a total of 17,400,000 shares of General Motors stock, 85.21 per cent. was in the names of investors, the balance—14.79 per cent.—representing all that was left in the hands of brokers on that date. Millions of additional shares of stock are listed each year but, due to the absorption by investors, shares are less plentiful than they were years ago when United States Steel had more capital stock than any other corporation. But Steel is now far down on the list, thirteen corporations with stocks listed on the New York Stock Exchange having more shares outstanding. There are, indeed, no less than nine corporations, each of which can boast of more than 10,000,000 shares of common stock.

REALIZING that the present and ever-increasing distribution of securities is a subject touching practically every home in the land, the editorial director of SCIENCE AND INVENTION *has decided to include meritorious articles on this subject in forthcoming issues.*

The accompanying article presenting the background of the financial phenomenon which has gripped the American investing public during the last several months will, we believe, prove of exceptional interest to you. It will be followed with articles setting forth every phase of the investment structure, in which articles the safety of investments will constantly be stressed.

As an added service to readers of this magazine, authoritative information regarding any security will be published in these columns and also supplied to inquirers free of charge. Every letter of inquiry should contain the name and address of the writer and a two-cent stamp (preferably a stamped, self-addressed envelope) for reply. Address your letters to The Financial Editor, SCIENCE AND INVENTION, *381 Fourth Avenue, New York City.*

But this widespread distribution of securities brings us face to face with problems that lately have risen to tremendous proportions. Observing the upward trend of common stock prices due to the vast expansion in our national wealth and sharing almost universal optimism of the future, small investors as well as large ones have sought to increase their units of partnership in American enterprises. In short, millions of people have bought stocks for the rise. Utilizing what is essentially the mortgage principle, they bought the stocks on a down payment plan—the payment varying with the particular stock in the transaction—and relied upon their broker to carry the balance of the purchase price on his books, paying therefor a varying rate of interest, depending upon the supply of loan money available. Such a partial payment plan is called "buying on margin," and the loans procured by brokers to thus carry the stock for their customers is termed "call money." Some days the interest rate for this call money is low; at other times it is high. Lately it has gone as high as 20 per cent., which has made it too costly for this class of stock buyer to hold onto his buy, with the result that stocks have had to be sacrificed for what they would bring; in which case the margin buyer would probably lose all the money he had invested in such stocks.

Thus of late we have heard a lot about speculation, which term has come to embrace many varied and sometimes erroneous meanings, but which nevertheless has risen to such a height as to tie up tremendous sums in securities held by brokers in the names of their customers, who may have bought them as investments or who may have been more concerned with making a quick profit on the rise. Who is capable of telling whether the buyer of securities on the margin payment plan is a hopeful investor, an ambitious speculator or a reckless gambler, acting on nothing but a hunch? And who knows where legitimate values end and inflation begins?

These are some of the questions that the Federal Reserve Board, responsible bankers and economists have labored with the past few months in an effort to arrive at a clear understanding of the interwoven investing-speculation-gambling situation. Not wishing to thwart the ever-increasing number of small investors in their desire to own securities in which they have unbounded faith, nor yet being willing to finance purely speculative or gambling activities, clear-thinking bankers and brokers have come around to what virtually is a compromise thought advanced by Charles E. Mitchell, Chairman of the Board of the National City Bank; that is, requesting purchasers of securities to put up from 33 to 50 per cent. of their own funds to buy the stock they wish. This will ease the credit situation, they say, and make for greater stability of values, eliminating as it should do the reckless individuals who make stock purchases on a 10 per cent. or under margin. According to well authenticated reports, large investors and investment trusts are now buying up good stocks and taking them out of the market. Many small investors are following their lead, for they have come to realize that buying a third or a half as much stock outright or at least purchasing a 50 per cent. equity therein will do much to relieve the costly money situation and also result in less daily worry to the holder. This appears to be the most logical way to bring order out of the involved credit situation which has risen side by side with the towering public interest and which, in turn, has resulted from the widespread distribution of securities.

But the difficult credit situation was not the only outcome of the recent publicly interested market. Among other things, there came to light a more or less difficult liquidation phase. While banks, corporations and other enterprises have made it easy for the man of small means to buy their securities—even on the installment plan if necessary—they have not made it anywhere near as easy for him to convert these evidences of value into money. Obviously, where 16,000,000 investors are involved, there is bound to be a wide shifting in investment positions, and liquidation facilities to serve the needs of the small investor must therefore keep pace with the ever-expanding security situation.

Automatic Garage

(*Continued from page 204*)

The electric *parker* itself is a small, rubber-tired steel truck affair, equipped with two motors, both of them reversible and controlled remotely by the elevator man. He operates a four-way lever switch. Pushing the lever to the left, the parker runs out on tracks suitably provided for it, to a position underneath the car that is to be parked for the day or perchance that is to be taken down and delivered at the street level. The elevator man operates this lever switch by pulling it up. This causes the rack on the parker to raise up and engage the differential axle housing, through the agency of a rubber-covered friction grip. The car is now pulled on the elevator by this electric parker. The high-speed elevator doors are now closed and the car is brought to the desired position. The elevator automatically levels itself at the delivery floor. Then the towing unit pulls the car out, the coupler is lowered, and the towing unit is run back on the elevator again.

Should a man call for his car, he presents his claim check to the cashier. Instantly the telautograph in the elevator operating in the particular section of the building to which the car was consigned, writes its message on a roll of paper. This message first gives the floor where the required car is to be found. By this time the elevator operator has already started to ascend. Next it tells the operator whether the car is toward the front or rear of the building. By this time the elevator man has probably reached the floor where the desired car is to be located. Meanwhile the telautograph continues its message and gives the license number as well as the make of the car to the operator. This is for the purpose of avoiding disputes. Running his parker under the desired car, he tows it on the elevator, and starts down. Perhaps on the way down he gets a call for another car, and he picks this up en route. Meanwhile the cashier is making change, and just about the time that the car owner leaves the office of the cashier, he finds his car waiting for him at the street level, ready to drive away. At no time in the entire process has his car been started, nor is there any possible danger of having the car smashed by close parking by the hand truck process.

An actual investigation of this garage by the editors has disclosed the fact that some cars are delivered to the owner within 50 seconds of the time that he enters the office of the cashier, and on occasion, even before some owners had left the cashier's department to take their position at the elevator entrance.

The Kent garage has also added many other radical improvements. For example, in the basement there is a complete system provided for the greasing and washing of automobiles. Everything here is done electrically. High-powered mercury vapor lamps provide light wherewith the slightest speck of dirt can instantly be observed. There is a rack for messages to chauffeurs. And a room for them where they can while away many an hour. A telautograph here delivers any messages left in the offices downstairs. Lounges for owners and their wives or husbands are also to be found. These are fastidiously decorated. These rooms are provided with every facility, including showers and dressing quarters. Safes are found on the street floor where purchasers may send any articles they might have bought until they call. When they do, an attendant notifies them that parcels had been left for delivery during the day. Oil and gas can also be obtained on this street level.

The operation of the garage must really be seen to be appreciated.

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Fountain Toothbrush

(1174) Ben Weller, Altoona, Pa., asks whether we think it advisable for him to protect an idea for a fountain toothbrush in which the tooth paste is contained within the hollow handle of the brush and is expelled by means of a piston, acting within that handle.

A. Similar toothbrushes have been patented heretofore, but they do not seem to find a ready market. The reason for this is quite obvious. The tooth paste remains at the base of the bristles and it either cakes and hardens or else produces a very unsightly looking tooth brush. If it hardens, it is difficult to loosen the paste at this point again. There is no way of closing the nozzle of this toothbrush, so that the paste will be washed out at the base of the bristles and further contact of the paste with the air will be prevented. In addition, there is difficulty in filling the tooth brush handle with dental paste and a constant annoyance in expelling it.

We advise no further action on a product of this type.

Aircraft Engine

(1175) James L. Hartley, San Francisco, Cal., has designed a new type of aircraft engine, in which a three-lobed cam is actuated by rollers connected directly with the pistons. This engine has no moving crankshaft. He asks our opinion of the system.

A. We do not see any apparent advantages of this method over the Caminez aircraft engine, which also uses a cam-like arrangement on which the piston acts. While there are many styles of aircraft and automobile engines that seem to be superior to those on the market today, and while many patents have been taken out on new types of engines, the difficulty the inventor has in each case is to find a manufacturer for his product. A large automobile organization that has spent thousands of dollars on dies and tools for the making of engines does not care to junk this material in order to take up the manufacture of a new style of engine, the worth of which has not even been proven.

If you are confident that you can secure a manufacturer, then by all means patent the idea. Otherwise the venture appears extremely hazardous and we would suggest no further action.

Sugar Dispenser

(1176) R. C. Naylor, Fresno, Cal., asks what we think of an idea for a sugar dispenser in which one spoonful of sugar is delivered at one time, whenever the dispenser is tipped.

A. There are many articles of a similar type which have been protected that do not seem to meet with a very favorable market. Your own idea presents no marked advantages over these. At one time it was thought that such products would be ideal for chain restaurants. The restaurants have not taken advantage of the opportunities offered by some inventors, with the result that such sugar dispensers are but rarely found. Because of the difficulty of market, we would advise no further action.

Bricklaying Machine

(1177) Burton Murray, Lynn, Mass., asks what a bricklaying machine should do in order to be successful.

A. We believe that an ideal bricklaying machine should distribute the cement on the underlying bricks to the proper thickness; that it should properly set the bricks and align them, so that the bricks will be truly horizontal, the wall perpendicular, and there should be no necessity of resetting or straightening the line of the building. Such a machine would have to lay bricks at a speed of three or four times that of the average laborer, and its efficiency would have to be demonstrated.

Perpetual Motion

(1178) Floyd Rahm, Turton, S. Dak., submits an illustration of a perpetual motion machine in which there are a series of cans connected together in a sort of endless chain. These cans travel over two drums, disposed some distance apart and vertically arranged. On one side the cans pass through a tank of water with a tight fitting washer at the bottom thereof, so that the water will not leak out. He reasons that one side of the chain is acted upon by gravity, the other side is lifted up by the buoyant effect there produced, with the result that the mechanism should operate continuously.

A. Such a mechanism is not at all new. It has been displayed in past issues of this magazine. The difficulty with the system is that the weight of the water is so great that unless the valve through which the cans enter is rather tight, the water will flow out at this point. A tight joint here precludes the possibility of motion. We might mention that while this idea has been previously displayed in SCIENCE AND INVENTION magazine as well as in several books on the subject of perpetual motion, it has also been recently patented, but not ostensibly as a perpetual motion machine.

In the patented article the spokes of one of the drums are perforated with holes and air is admitted through the axle or bearing. The reaction of the air is intended to produce the desired motion and the production is to be employed (at least according to the patent specifications) for advertising display.

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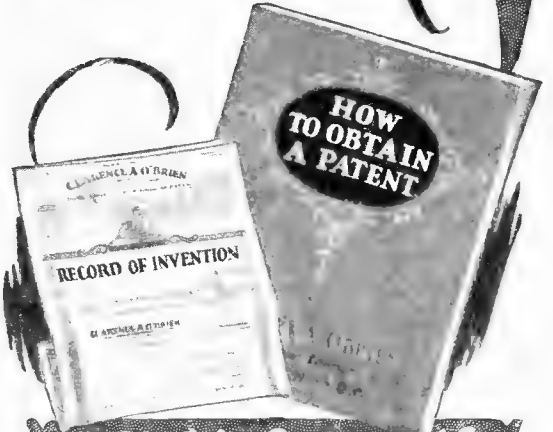

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How I Broke the Women's Airplane Endurance Record

By Elinor Smith

(Continued from page 205)

used to see the boys flying and they used to let me handle the controls from the time I was ten years old. By the time I was fifteen I could stunt and handle a ship perfectly in the air, but I couldn't take off or land it because I was too short.

About that time I had saved up some money that had been given me and I began getting up at 5:30 in the morning, sneaking out of the house and driving over to Wantang for instructions. I'd get back home about 7:30, get into bed for a half-hour and then get up and go to school. The family didn't know anything about it until after I'd soloed. As a matter of fact, I really made a solo flight after about three hours of instruction. Oh! They were surprised all right. But I must say they were good sports about letting me go on with it, no matter how much afraid they may have been. Sometimes I hear that people criticize my folks for letting me do what I'm doing, and it makes me provoked, because I think it means a lot to have a family that is willing to let you go ahead with a thing, once you've made up your mind you want to do it.

Now I want to make a solo hop to Rome. When I get that off the boards I'll be satisfied. My family isn't willing, but I'm trying to talk them into it. Of course, I don't think it can be a non-stop flight. My doctor thinks I'm crazy to think of it—but I don't. I'm always hearing of folks starting to do it—but nobody ever gets there. And I'd really like to see somebody do it—and I'd like to do it myself.

I don't know, of course—but I think that it's going to be shown that women have greater endurance in the air than men. I know that women make better passengers than men. They don't get half so nervous and fidgety. I don't know why it is, unless it's because men are used to driving their cars and taking the responsibility and that makes them worried if they're not driving a plane. But most of the women passengers I've taken up just sit back and enjoy the scenery and don't get nervous at all.

If I can get women interested in aviation and help to convince them that there isn't really any danger in flying, I'll feel that I've done something—because I think that as soon as women get over being afraid of it, they'll let their men folks go ahead with it and not stand in their way. After all, there are only two things that can happen to you in a plane that are dangerous—one is a fog and the other is that your plane might catch fire. But both these can usually be avoided and after all, we are putting aviation on a safe and sane basis, so it really pays to check your motor and weather map before starting on a flight, and make the possibility of either of these two so slight as to be almost negligible.

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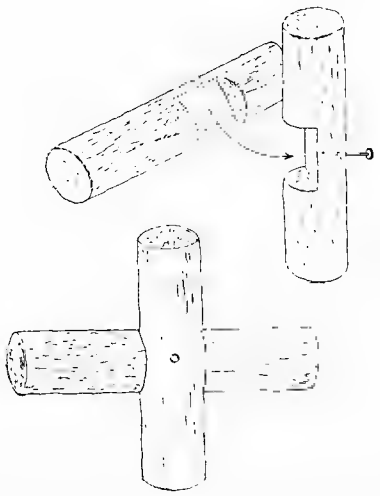
How to Build a Rustic Summer House

By Dr. Ernest Bade

(Continued from page 242)

Using such wood is only a waste of time. The latter practically crumbles at the touch while the other rotted pieces soon decay so that they will not last. The wood does not have to be dry nor seasoned. If the wood is fresh and still contains sap, it is much easier to work and nails may be driven in freely without much danger of splitting. If the wood is dry, it will often be necessary to bore holes before nails are driven. If the work is to be exceptionally durable it is advisable to use galvanized nails. These do not rust nor will the wood be affected by rust as with other types of nails. Further precautions may be taken by rubbing the nails, that is the galvanized nails, with fat such as the rind of bacon. This will make them easy to drive and they will have still less occasion to rust.

Special models for such houses are practically useless, for the available woods both according to size, shape and form differ too much among themselves. General ideas only can be given, the final result depending upon the surroundings and the material at hand.



The above illustration shows the manner in which the limbs are cut in order to form a cross-joint. A nail holds the two pieces of wood in place.

$5,000 FOR PERPETUAL MOTION

The editors have received thousands of different designs of perpetual motion devices, and have received hundreds of circular letters soliciting finances for the building of perpetual motion machines.

The editors know that if they receive these letters, there are thousands of others in this country who get similar letters and who fall for the claims made in the numerous prospectuses giving the earning capacities of the various machines.

Most of the shares of stock for these perpetual motion machines are being sold at a rate of $1.00 per share, although some inventors are trying to sell shares of stock at $100.00 per share.

Therefore, the editors of this publication say, "Just come in and show us—merely SHOW us—a working model of a perpetual motion machine and we will give you $5,000.00. But the machine must not be made to operate by tides, winds, waterpower, natural evaporation or humidity. It must be perpetual motion."

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There are many objects in the picture of the circus to the left. See if you can find 5 that start with the letter "C." When you do this, write them on a piece of paper together with your name and address and send it to me right away.

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L. E. WILFERD, Mgr. Dept. B-379 315 South Peoria Street, Chicago, Illinois

A Hand-Propelled Boat for the Kiddies

By Hi Sibley

(*Continued from page 239*)

Power Plant

INSTALLATION of the power plant is very simple. For the "engine" select a sturdy breast drill that takes square shanks up to ½-inch. (This model designed for any drill similar to a Goodell-Pratt No. 1200.) Screw two wedge-shaped blocks to top and underside of central bottom board before boring hole for propeller shaft. Locate the angle for boring by means of a straight edge. Forty degrees is about the limit; otherwise the propeller drives upward too much. The hole should be an easy fit for a galvanized iron pipe of ⅝-inch inside diameter. After the boat is in the water the wood will swell tight.

This propeller tube should be about 2 feet 4 inches long and threaded at both ends for caps. The caps serve as shaft bearings and should be accurately drilled in the center ½-inch plus. Square one end of a ½-inch cold rolled shaft 2 feet 11 inches long. This is to fit the drill chuck, and can be done satisfactorily on a grinder.

Insert the shaft in the tube, and the squared end in the chuck. This will enable you to locate the 2 x 4 support for the breast plate. It is important that the drill is carefully aligned with the shaft. Otherwise it will bind and work hard. The handle on the left side of the drill is supported by a 2 x 2, with a brass or iron strap over it, as shown in the drawing.

Propeller

NOW comes the propeller. White pine will be satisfactory for the hub, and besides, it is easily turned and carved to shape. The whole job can be done with saw, jackknife, chisel and brace-and-bit if you have no lathe. First drill a small guide hole in a block 2 inches square by 4 inches long. Using this hole as a center, describe a two-inch circle on each end with a compass. This will enable you to get the shaft hole properly centered. Then bore a ½-inch hole. Next whittle the block into a two-inch cylinder, and saw it across, 1½ inches from one end.

Now comes the most difficult part—carving the sawed ends so that, when fitted together again, the joint will be curved to hold the two propeller blades at the proper angle. This is more easily worked out in practice than described on paper.

Use a fairly heavy gauge brass or galvanized sheet iron for the blades. Drill two holes in the lower end of each for screwing to the forward section of the wood hub. When the two ends of the hub are fitted to your satisfaction, insert the shaft and drill a ⅛-inch hole in each, through the shaft, for pins. Next streamline the hub as shown. Your power plant is now complete.

The steering gear comes next. A discarded toy motor wheel of small diameter serves for the steering wheel. This is mounted on an upright shaft supported by a board fastened under the seat, and a block at the bottom. The cable winds on a wood spool or drum about 4 inches diameter.

Small pulleys guide the cable under the decks inside the side boards to the tiller. A ½-inch wrought iron bar 24 inches long is flattened at the lower end and bent at a right angle at the other for the tiller bar. For the rudder use either heavy gauge galvanized iron or a ½-inch piece of wood about 6 inches wide by 9 inches long.

Staples are used to hold the rudder bar to the wood stern post, and cables are attached to wire loops in a brass sleeve sliding on the tiller bar. Slack in the cable is taken up at one of these loops, and is always accessible.

Cabin and Seats

A DUMMY cabin adds to the appearance and also serves as a coaming to protect against spray—if the engineer can get up enough speed. This is made of sheet iron, with portholes either painted on or cut through with a chisel. A board cut in a semicircle supports the front end of the cabin. Forward and after decks are easily installed, as are the side decks—either of wood or sheet iron, preferably the former.

Note that the seats set just below the gunwale, and are supported on the uprights of cross frames C, D and F, which are shorter than the others. Before locating the seats permanently, the prospective pilot and engineer should try them for the most comfortable position.

In attaching the keel, use screws about ¼-inch by 3 inches down through the cross frames of the hull.

If you have put first-class workmanship into this job you will have a boat that will serve you many seasons. And some day, when you can afford a small gasoline engine, you can make a power boat out of her. The propeller shaft is at too high an angle to make a direct drive, but by means of auto fan pulleys and belt the motor can be set low in the hull. A small gasoline bicycle motor, equipped with a fan, will drive this little cruiser at a lively clip. That is something to look forward to.

Painting is *always* important. Having made a topnotch job of the construction work, your cruiser certainly deserves a good paint job. Our suggestion would be a battleship grey above the waterline, Chinese red below, including rudder and propeller hub. The cabin should be white with green rims to portholes, the deck cream, and mahogany stain inside.

The possessor of this little cruiser is going to be the most envied boy of local waters, and he is assured of a delightful summer's cruising without fear of motor breakdowns or running out of gas. Moreover, the ample beam makes this a very seaworthy craft under any ordinary conditions.

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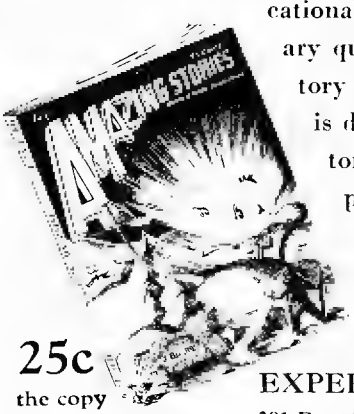

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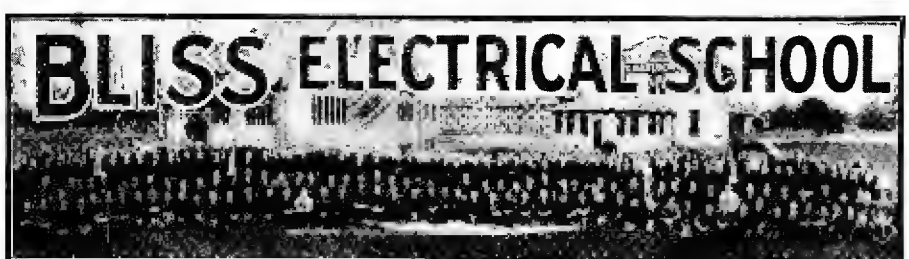

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Adsorption

By Raymond B. Wailes

(*Continued from page 231*)

prepared and one is shaken with Fuller's earth and allowed to settle. The earth adsorbs the dye upon its surface and leaves the water perfectly clear and free from dye.

4. Dyeing is a process of adsorption. A thick wad of cotton thrust into a cylinder of weak dye water will become dyed and the liquid become discolored, the cotton abstracting the dye from the water. Use a thick wad of absorbent cotton in this easily performed experiment.

5. The reason fireless lighters ignite the gas in our stoves is because the little speck of reactive metal in the loop adsorbs such a quantity of the hydrogen of the gas upon its surface that it becomes red hot.

6. Some substances are affected by adsorption more easily than others. The left beaker contains barium hydroxide solution and the right one hydrochloric acid. At the end of several minutes if a drop of methyl orange be placed on the right hand paper two inches up a coloration will take place. Only a slight distance up the left-hand paper will a coloration appear if phenolphthalein be touched upon it.

7. A drop of barium hydroxide is allowed to fall upon filter paper. An inch from it a drop of phenolphthalein is allowed to fall. Although the two drops spread out and their water mixes, a color will not form for some time, the dissolved chemicals moving only slowly along the paper, part of them being adsorbed upon the surface of the paper and held back.

8. Drop a crystal of potassium permanganate into a solution of barium chloride. Shake and add a drop or two of sulphuric acid. No matter how many times the precipitate of barium sulphate is washed as shown here, after filtering off, you cannot remove the adsorbed violet permanganate upon it.

9. Charcoal removes odors because it adsorbs them upon its surface. Hydrogen sulphide passed through charcoal will be adsorbed by it and will not discolor lead acetate paper held at the other end.

Artistic Hardwood Floors

By J. E. Lovett

(*Continued from page 240*)

and the ends of the flooring in the pattern jointed to the side board.

Of course, in laying a floor of this pattern, the simplest way is to lay a sub-floor, as shown at Fig. 5. This allows in the first place the joists to be set at the usual centers, but some distance down equal to the first layer of boarding. The pattern floor is then built on the top of the sub-floor, the joint being prepared in much the same way as when laid on the naked joists.

Designs for parquet floor coverings are shown at Figs. 6, 7, 8 and 9. These are composed of thin layers of wood worked in the geometrical patterns shown, and used as a border around the room. The parquet may be laid directly onto the joist, although it is best laid on a sub-floor. Sub-floors have many advantages even in straight-jointed hardwood floors, because when the finished floor is being laid it can be done as fast as the pieces can be laid in position and nailed.

In laying an ordinary floor without a sub-floor, all heading joints must come on the joist, necessitating frequent cutting back where the lengths project past the joists. It takes care and time to do that, and then there is the waste of material.

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"Perhaps my set will do a little better," I suggested. I had a surprise in store for him!

He looked doubtful as I turned on the set switch. I had left my old aerial antenna attached on purpose and soon the room was filled with an ear-splitting excuse for music. Manipulation of the dials only served to make it worse. Occasionally it faded out altogether. Then the howls would start up again until my wife finally shouted, "Turn that thing off—it's terrible."

Satisfied, I laughed and disconnecting the old aerial and ground wires I then attached the lead in wires of my new underground antenna, which I had installed just before dinner. "Now listen!" I commanded.

THE THRILLING TEST

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Spirit Séance Via Radio Produces Results

By Joseph H. Kraus

(*Continued from page 207*)

rubber-covered wires, which run down into the trousers as indicated by the dotted lines in one of the photographs. The wallet is well padded so that in even the most quiet room the spark coil makes no noise, nor does one hear the crashing of the spark across the gap. We thus have a miniature transmitting set fastened to the back of the performer, and concealed by his coat and vest. The key for closing this circuit is in the performer's pocket. He can press this from the outside of the trousers, it being unnecessary to put his hand into the pocket. Such an apparatus could easily be worn by the average male or female medium, and with its aid, many would become convinced of the truth of psychical manifestations.

The Receiver

THE receiving apparatus is merely an amplification of the old coherer and decoherer receiving system used in the days when wireless telegraphy was still young. Those who have experimented with radio in its infancy will recall the coherer filled with silver filings, and also will remember the electric bell that was originally used as a decoherer. In this apparatus, the decoherer takes on the form of a clockwork. When the signal is received (the two opposite legs of the table acting as antenna and counterpoise) the filings in the coherer cohere. In other words they offer less resistance than before, and current flows through the batteries and pulls down the armature of the relay. This closes the circuit to a second relay which releases the clock-work mechanism. A contact on the clock-work closes the circuit to the electro-magnet, the upright standards, the horn, or drums, as the performer desires, and the apparatus produces its sound or demonstrates its effect. At the same time that the clock-work closes the circuit, the hammer movement is brought into play and the hammer strikes the coherer a sharp blow decohering it, or in other words, shakes the filings in the coherer so that they assume their original resistance, and prevent the passage of current through them. This opens the relay circuit, and the apparatus stops until another signal is transmitted. As will be observed, there is a duplicate drum and horn in the table-top. The skull and hand are operated by magnetism, and inasmuch as there is no insulator for magnetism, it makes little difference if a piece of glass is placed beneath the skull, and the entire skull is covered with a glass cover. The effect on the public is unique, but the effect on the magnetic force is no greater than that of an air gap equivalent in distance to the thickness of the glass.

Significance

AFTER six years of experimenting with this idea, Mr. Dunninger has for the first time demonstrated the possibility of radio being employed for producing spirit manifestations. Here we have a demonstration of practically every spiritual effect, and all of these effects were performed in daylight. The phenomena were produced, whether the chairman of our Scientific Investigation Committee was in the room or whether out of the room; just as long as he pressed the transmitting key. It is conceivable that an apparatus of this nature could be used by a medium. It is also possible that one of the sitters at a circle could manipulate the apparatus and the medium himself could be searched, and found free of

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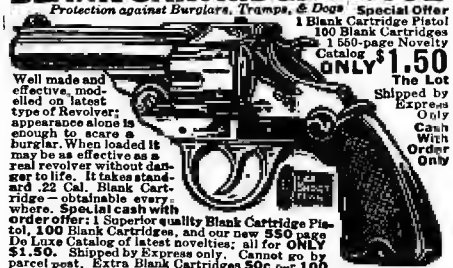

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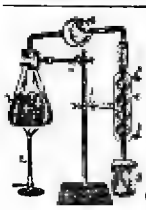

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trickery, or the operator would not even have to be in the room. While we do not claim that any mediums in the country are using this particular system, we are merely demonstrating that such methods are within the realm of possibility. For the benefit of those desiring to duplicate this effect, Mr. Dunninger has kindly consented to disclose the entire system, and the circuit diagram of the same is reproduced in this issue. As will be observed, both the skull and the hand are magnetically operated, the skull having a piece of iron in the base which operates the jaws whenever the magnetic impulse pulls this iron bar down. The hand is so balanced that it will just barely remain with the fingertips in the air, and these tips contain the iron cores required for the magnetic attraction. The electric light is a miniature 4½ volt bulb set into a standard socket with suitable adapters. The globe is opaque. The bell is an ordinary 3½ volt bell. In both these instances, the ribbons connecting with the standards are wired so as to make contact with them. We are showing here how unscrupulous mediums could even press radio into the service of producing phenomena, and no one in the audience would be the wiser.

New Advances in Medicine

(Continued from page 225)

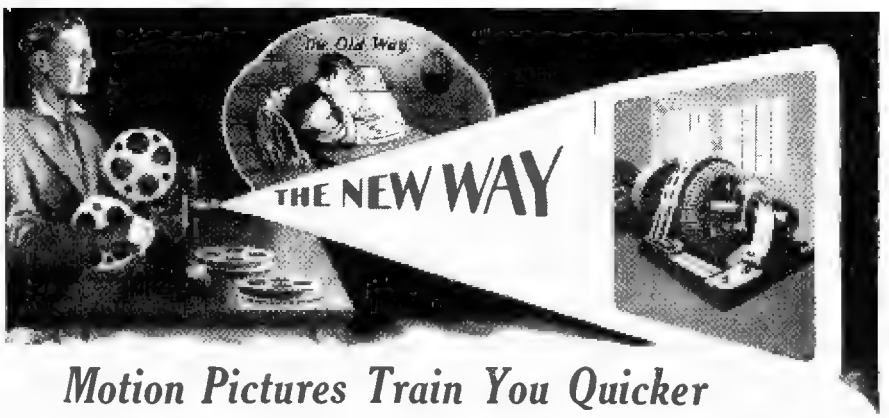
The Deadly Pocket

THE pocket and the pocket handkerchief, as well as the lady's handbag, are breeding places for germs. Take for example, the common handkerchief. During a cold, it is used many times, and each time that it is used it is returned to the pocket, but the pocket is nice and warm, and dark, with the result that the fresh air and sunshine, deadly to micro-organisms, is effectively kept away from this quarter, and the germs multiply rapidly. When the soiled handkerchief is removed, and sent to the laundry, and a clean one substituted for it, the clean kerchief again picks up the micro-organisms from the pocket and transfers them to the clean handkerchief. How many people, says Dr. H. Taylor Cronk, ever think of ironing out the pocket with a hot iron, or ever disinfect their handbags.

It is for this reason also that it is not a good idea to place your handkerchief over the telephone. Actual experiments have demonstrated that the telephone mouthpiece is far more sanitary than one gives it credit for being, and that the germs in the mouthpiece are no greater than one would expect from an equal area of air. And this, in spite of the fact that everyone talking through a telephone is apparently blowing many germs into the mouthpiece. The handkerchief defeats its own purpose. Not only do you add more germs to those which may be existing on the mouthpiece by using your handkerchief in this fashion, but you at the same time pick up any germs which may be on the mouthpiece, transfer them to your handkerchief, and then again, when you use that handkerchief, you transfer those germs to your nose, mouth or eyes. Last, but not least, you interfere seriously with telephone transmission.

Coloring Matter in Beverages Is Harmless

THE Department of Agriculture recently announced that artificial colors and flavors in soft drinks in nearly every instance are absolutely free of harmful substances. The department estimated that more than one hundred billion bottles of soft drinks were consumed annually in the United States, and that 250,000 tons of sugar, and 5,000,000 pounds of artificial color and 1,000,000 gallons of flavoring extract were used in these beverages.



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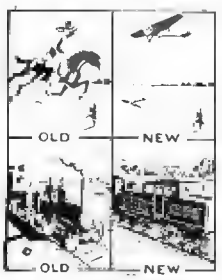

This motion picture method of home training is the very latest development. To compare it with the old style, book way is like comparing the 150-mile-an-hour aeroplane with the old Pony Express.

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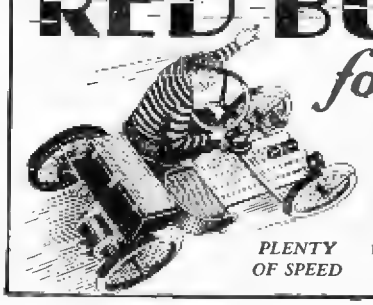

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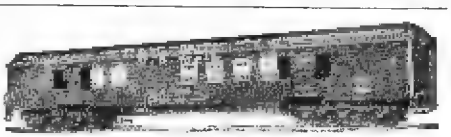

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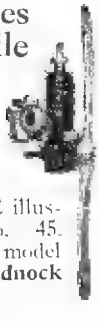

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Is a College Education Worth While?

(*Continued from page* 201)

prefer to change the heading so it would be: "What Makes a College Education Worth While?"

It is evident I am taking unusual liberties with the editor. I am quite willing to hand him free, an extra page or two as a palliative. I will, however, give him his money's worth on the first page, by saying I don't believe a college education can ever produce permanent injury to the mentality of any normal boy or girl.

In discussing either the assigned headline or the converted one, we might well ask: "What is the function of a college education, and what is it supposed to do for the normal boy and girl?" If a college education has excuses for being, what at least are some of them?

Surely many men who have never received a college education have become noted. Why?

Prof. F. E. Austin.

Because they rose above the environments of their birth; mentally at least. By determination and continuous application, they trained themselves until they became more efficient mentally than their fellows. These noted leaders who trained themselves, or as we sometimes say were "self educated," had initiative. There was within them the mastering desire to become great engineers, renowned musicians, or noted artists.

The incentive to become an educated and cultured man or woman must come from within one's self. It is an impossible and quite as undesirable a method, to kick culture or renown into a human being.

I am certain that a college training is more valuable to the boy who enters college on his own initiative than to the boy whose parents send him because they do not know where else to send him or to the boy who himself does not know where else to go.

If a boy has no objective in life, he should buy or borrow one. Above all, don't steal one. Any boy who makes up his mind to become educated and cultured can become so. He may become so without the help of a college training. I believe he will reach his goal quicker via the college.

Some of the reasons for the time saving are evident when one considers the facilities of libraries, laboratories and museums. These facilities are especially valuable to the boy who has made up his mind as to the nature of his life work or his profession.

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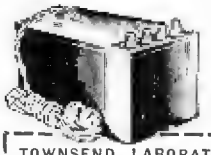

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Choice of a College

IF a college education is to be worth while, an important consideration is the choice of the college. It would obviously be undesirable for a person wishing a liberal-arts education to spend four years in a technical school; or for one wishing to become an electrical engineer to attend a conservatory of music. Between these extremes, the choice is often difficult.

During my term as Professor of Electrical Engineering in the Thayer School, connected with Dartmouth College, I had in my classes several students who later went into business. I asked the students why they pursued engineering courses when they knew in advance they would enter upon business careers.

Their replies were similar in purport; that the engineering courses offered in the Thayer School seemed to them to furnish as desirable a foundation for a business career as for engineering. The courses were short, intensive and thorough. While the curriculum was highly specialized, the method of teaching the various subjects was broadening and inspiring.

The fundamental principles underlying any profession are neither many nor difficult of comprehension. The fundamentals of the engineering profession are not dissimilar to those of business.

You may possibly have been amused at the suggestion of a prospective electrical engineer attending a conservatory of music to obtain his training; yet did you ever consider the fact that Fourier's Theorem, which forms the basis for analyzing alternating currents and radio waves, also furnishes the determining criteria that differentiates a ten thousand dollar "Strad" from a two dollar ninety-eight fiddle?

The pupil attends the conservatory chiefly to become proficient in technique; while the student attends the electrical engineering college to become conversant with the efficiencies of dynamos, engines and transmission lines.

While the fundamental principles of alternating currents and musical sounds are identical, the applications of these principles so far as the musician and engineer are concerned are widely divergent.

Knowledge of the Universe Essential

COLLEGE courses that teach a boy to appreciate the world in which he lives make a college education worth while.

Were I at present choosing a college in which to obtain an education I should above all choose one that offered courses in popular astronomy, geology, botany and zoology. This, regardless of my chosen profession.

Knowledge of the origin of the earth is a determining factor in authentic predictions as to its destiny. Astronomy reveals a wealth of information concerning the origin and early development of our earth, before it became solid, and cool enough for geology to continue the interesting story. The story of the earth's adornment by luxuriant growths of vegetation is told by botany and the final climax of animal life by zoology. There are so many and so important relations between engineering and zoology that every engineer should have a working knowledge of insect life and habits. White coal and black coal produce culture and mechanical power.

Discipline Makes a College Education Worth While

I HAVE listened to a group of girls at Wheaton College (Norton, Mass.) vigorously criticizing the faculty of that institution for the strict supervision to which the students were subjected. This was the best advertisement Wheaton could have had.

You may safely adopt the principle that enrollment for a four-year course in an institution in which the students as a whole find fault with restrictions, will never prove a mistake nor cause you serious regrets.

A college student should not expect, nor ever receive, greater immunities from the observance of law and order than does the ordinary town boy. It is an injustice to the students themselves to pass lightly over their misdemeanors; either in court or out, simply because they are "college boys." Such favoritism produces a false and dangerous conception of values in a student's mind, and greatly lessens the worth while asset of a college training.

Advantages of College Athletics

WHEN I entered college I was unable to "chin" myself on a horizontal bar. I took a course in "Gym" work and within a year I could chin myself rapidly and successively from fifteen to twenty times. Before graduating I won three medals on the team; simply because of conscientious and systematic training.

When a college education produces a proper balance between mental and physical development, it cannot be other than worth while.

Serious consequences are as likely to result from physical over-exertion in strenuous games such as football, or result mentally from over-study.

Financial Asset of a College Education

THERE is no question but what the same individual will be worth more financially ten years after graduation from college than if he pursued the same vocation without the college training.

In my own case, I have demonstrated that I am well able to earn a living by my physical efforts with a college education as I ever was before. I do not believe that any healthy boy or girl will ever be handicapped physically by a college education.

I furthermore believe that in my own case the regular systematic training that I received in the gymnasium and on the track greatly increased my ability to perform manual labor.

I do not feel that a college education should be evaluated in monetary standards. The standards of evaluation should be effective character building and high ideals.

College Friendships Make College Education Worth While

I BELIEVE one valuable asset of my college career was the staunch and true friends I found in college. It is true friends that make this life worth while; not money.

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These tokens of friendship made my Dartmouth College education unspeakably worth while to me.

(*Continued on page* 281)

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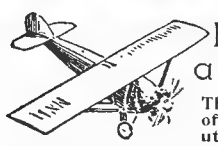

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Under the Ice to the Poles

An Interview by H. Winfield Secor, with Simon Lake

(*Continued from page* 209)

receiving set on the "Defender" for the Wilkins' polar trip, and suitable means for providing heat will also be provided.

Navigating in Polar Seas

CONTRARY to the general impression, perhaps, the polar seas are not filled with icebergs, as Mr. Lake brought out, and he should know, as he has tried out submarines in northern waters, in the Gulf of Finland and in the Baltic, and in these instances he was successful in causing the submarine to break upward through ice of considerable thickness. In these northern regions there are quite large bodies of open water, said Mr. Lake, and by and large, the submarine is the logical craft to use for exploring and carrying on communication in these regions. The ordinary steamship or sailing ship is at the mercy of the ice in a great many cases when she is trying to navigate through polar waters, and frequently the vessel becomes quickly jammed or frozen in the ice, and can't move at all for considerable periods of time. If a submarine commander, under like conditions, saw the ice closing in on him, he could submerge and navigate his craft beneath the ice. Submarines, as is well known, can descend to depths of 150 to 200 feet, and in extreme cases, tests have been made at a depth of 300 feet.

One of the most interesting questions of all, naturally, in any such undertaking as this, resolves itself into the problem of how the navigator can find his way under the ice. In the first place, navigation would be by compass in the same way that a vessel is navigated on the surface. The depth gauges will show at all times how deep the submarine is below the surface of the water.

One of the questions that came to the writer's mind while he was interviewing Mr. Simon Lake recently was, supposing the submarine blasts a hole upward through thick ice, the submarine having to back off from the point where she has planted a time-fuse bomb, let us say, and the question arose, how could the submarine commander find his way back to the hole which had been blasted in the ice? One answer would be to steer by the compass, but suppose the compass was out of order or was rendered unworkable due to the blast, and also let us assume that the compass did not permit the commander to find the hole blasted through the ice, for reasons of inaccuracy of navigation, et cetera, how would the hole then be located?

Follow the "Black Line"!

MR. LAKE laughed, and said that this was one of the simplest problems to solve, and in fact, some of his early patents, which he showed the writer, contained several methods for solving just such a problem as this one. Some of these schemes of Mr. Lake's are illustrated herewith. Anyone who has traveled in New York subways is familiar with the rule, "Follow the green line," and the sub-sea polar explorer of the immediate future may very likely find himself faced with a similar order, "Follow the black or red line," and he will then come to the hole which has been blasted through the ice.

After Mr. Lake had explained his methods, the writer suggested why not squirt or paint a black line on the underneath surface of the ice, as the submarine retreats from a point where a time-fuse bomb has been planted, for example. Mr. Lake said "Bully." (The bomb may be fired electrically from the submarine.) It should be mentioned in passing, that the "Defender" has a special chamber, whereby it is possible for a diver to get out of the submarine and make any investigations necessary. Aside from this fact, however, a marker line on the bottom of the ice, such as that just described, could be seen by the submarine commander through windows, and under some conditions there would be sufficient light transmitted through the ice; or otherwise powerful lights suitably mounted on the top of the submarine would illuminate the under side of the ice.

Other schemes devised by Mr. Lake, and which are indeed ingenious, comprise a toothed wheel which will retrace its path by means of the indentations made in the ice, as one of the pictures show. Still another idea involves the use of a small cable which has been anchored in the ice near the point where the hole is to be blasted through it, and the submarine is then maneuvered back toward the hole, after the explosion, by reeling in the cable, in the same way that cave explorers sometimes follow a string back to the point from which they started.

Telescoping Periscopes

IN the numerous patents and ideas worked out in the past 30 years by Simon Lake, who has built more submarines for the great governments of the world than any other individual, there are numerous means provided for arranging telescoping periscopes, observation towers and also electric as well as pneumatic drills, which can be put to work through the top of the submarine when deep ice is encountered. Suppose, for example, that a submarine has been maneuvering for quite a while, and that the commander decides, from the depth gauges, that he is under a considerable thickness of ice, say 15 to 20 feet or more, and that his air renewal apparatus and oxygen supply will not enable the crew to remain submerged much longer. He can then, said Mr. Lake, resort to one of several methods of procedure: He can drill upward through the ice and run a tube up through the hole to give fresh air to the crew, or he can arrange to blast a hole upward through the ice with T.N.T. or other explosive. While a considerable quantity of ice is encountered in the polar seas, they are not filled with a lot of icebergs as we frequently imagine, Mr. Lake pointed out. The icebergs, representing large pieces of ice which are broken off glaciers in Greenland, for example, find their way to the north Atlantic, and they are frequently seen in the northern ship lanes. On the average, Mr. Lake told the writer, one may look for polar ice about three feet thick when it is encountered in summer, and as great as 14 feet thick in the winter, with many lanes of open water.

In the
AUGUST ISSUE

A Scientific Mystery Story—
"The Invisible Incendiary"
By F. N. Litten

More Opinions on—
"Is a College Education Worth While?"

"Financial Independence"—
How to Obtain It!
By John J. Raskob

Home Movies

Conducted by Don Bennett

(*Continued from page 229*)

side of the street. He repeated this for forty or fifty feet of film, and developing his film to a negative, spliced the fades so that they lapped one another. When the print was made the effect was that of buildings and scenery fading from one scene to another, but each scene moved across the screen in the opposite direction to the preceding one. He had built up a rhythm to this change of direction until finally the scenes became so short and the changes of direction so fast that one felt accelerated in time with the screened picture. A judicious selection of music on the phonograph accompanying this enhanced the effect.

A Remarkable "Fish Story"

THE prize winner, however, was presented by the leading light of the Rockland Movie Club, George Blake. It was a short film entitled "Fisherman's Luck" and was only a little over a hundred feet in length. There was not a title in it except the main title, and the opening scene showed a float bobbing on the water. The camera followed up the line, down the rod, and up to the fisherman's face. The fisherman was evidently asleep but his hand raised automatically to brush away a fly. This was all in close-up and then the camera was moved back until the whole scene was taken in. Suddenly there was a jerk at the line, the fisherman woke up and hauled in a beautiful fish, after quite a battle. He deposited it in his creel and cast again. Another fish struck, was hauled in and deposited in the creel. This kept up, getting faster and faster until the fisherman threw down his rod and started scooping them out of the water. As he did so, the scene dissolved into the first long shot where he was asleep and he woke up to find it raining. Hurriedly reeling in he discovered a great weight on his line as if it were snagged, but a little judicious pulling freed the line and he pulled up—an old boot. *Fade out.*

How to Take the "Fish" Movie

SUCH a film at first glance seems difficult to make but when you consider that only one fish was used, it is not as hard as it seems. The procedure is as follows: Make the opening scene as described above. Set up the camera for the long shot and fasten a fish to the hook. (Buy it at the fish market if you are *not* a lucky fisherman.) Have your actor take his sleeping posture, the rod loosely held, and with a thread running out of the camera vision line, simulate a "bite." At this he wakes up and battles the fish (tugging the thread keeps his rod under tension) and lands it. We then cut to a close-up of the creel, *not showing the inside of it*, however, and then cut back to him *finishing* a cast. (In taking the scenes, make all the casts at one time, and all the close-ups at one time, then cut them together.) Your fisherman can fake a cast and you can cut out the unwanted part so that you get the *effect* of him casting, although you do not actually see him do it. Vary the action slightly in each shot and especially in the close-up. When you come to the scene where he drops the rod and starts scooping the water for fish, fade out and move your film back (in a changing bag) to where the fade started. Then fade in again *under-exposing* and have him wake up, look at the sky and start to gather his gear together, following the action described in the paragraph above. Where he looks up at the sky, cut in a shot of a black cloud hiding the sun, made at any time, to get the idea across that it is raining. With this in mind, the action had better be laid in a shady place so that the presence of shadows will not give away the fact that your rain scene is faked. Throw sufficient light in with reflectors to illuminate the fisherman.

There are many similar tricks that can be done with a little thought, and remember—the trick with a little thought and continuity to it has a better reception from your audience than just a camera trick that means nothing.

(*Next month's article will contain hints on improving your vacation film, with some suggestions for titles and for a continuity that will dramatize your film.*)

(Names of manufacturers of devices on request.)

Movie Question Box

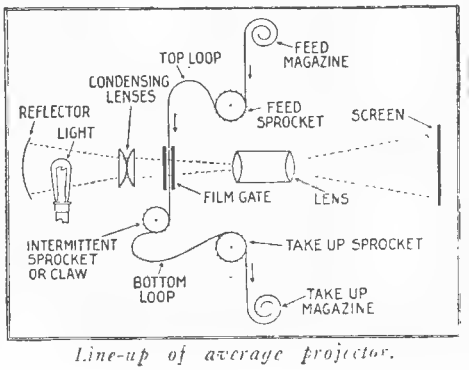
Q. by R. Madden: What is the difference between "Hard" and "Soft" lights.

A. Hard lights are the bright arcs used in studios because of their high actinic value. They use carbons for forming the arc similar to the miniature arc described several months ago in SCIENCE AND INVENTION. They are hard because their rays are nearly parallel and throw shadows that have solid edges, going from deep black to brilliancy with little or no diffusion at the edges. In studio practice, Florentine glass (crackle surface) is used to break up the parallel rays and diffuse them and silk masks are placed in front of the lamps to further soften the glare and to diffuse the edges of the shadows so that they do not show so plainly in the film. "Soft" lights are usually incandescent lamps, which because of their large source area, give a more diffused or softer beam and because when used as a reflector the diffusion is even greater, altho a diffusing silk is not used. Arc lamps for amateur use vary in current rating from 8 to 26 amperes, whereas incandescent lamps range from 500 to 1000 watts. In the studio the arcs draw about 45 amperes for the smallest up to about 150 amperes for the giant "Sunarcs." Incandescents used in the studios run from 1000 to 10,000 watts. Reflectors are always used, either in amateur or professional use.

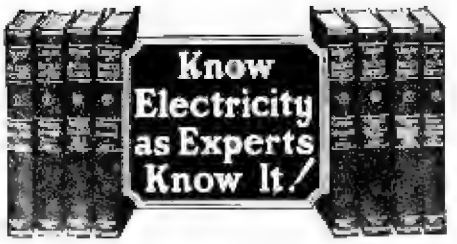
W. Stuart asks:

Q. Has a book ever been published containing directions on how to build a home movie projector?

A. To the best of our knowledge it has not. There are some parts of a projector that require accurate machining. You may be able to buy cheaply an old intermittent movement from a movie junk shop, along with two feed sprockets. These could be mounted on a metal frame and driven together by a chain and sprocket arrangement or by gears. Fig. 1 shows the basic principles upon which all movie projectors are designed.



Line-up of average projector.



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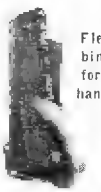

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How to Build Your Own Airplane

By George A. Gerber

(*Continued from page 237*)

design of the ship. Before changing anything in the design or size of materials, be very sure you are improving; then go ahead.

The design of this ship has proven to be exceptionally stable and safe. Due to parasol type, wing airfoil chosen and further design, it has been impossible to spin either this plane or the two place training plane (Jenny fuselage monoplane wing with OX5 motor).

The airfoil has no sharp burple point; the ship will mush along in altitudes which would be suicide in a Jenny or Canuck.

I speak of these two ships especially, because youth, and it is to the youth of the country I dedicate these articles, persists in grabbing off any old war-time crate with half an engine in it, and try to fly it.

These planes were no toys or playthings when brand new, and now, after 10 years of existence, the only names fitting to them are flying coffins or crates.

True, they were good training buses; once a pilot can fly a Jenny or Canuck he can handle, with safety to himself and ship, almost any commercial plane built today.

This little plane has the positive feel on the stick experienced with a heavy plane, yet is light on the controls. Most light motorcycle engine-powered planes fly like a butterfly, quick, snappy, and require a clown pilot to fly them.

A characteristic of this plane is its ability to plow through the sharp bumps and gusts without undesirable oscillation.

In a dive, there is no tendency towards nose heaviness or in a climb no tendency of tail heaviness outside of sloppiness of control which is present in any plane at slow speeds.

The Chevrolet motor was chosen in preference to a Ford, because of built-in features of overhead large valves, large bearing surfaces, pressure oil system, etc.; none of which are found in the Ford regular engine.

I am neither a professional draughtsman and far from being an author, but I have tried to present this clearly.

Remarks on Flying the Plane

IN the final set up of the plane, I had the fuselage on the landing gear, tail plane assembly attached, everything covered and doped.

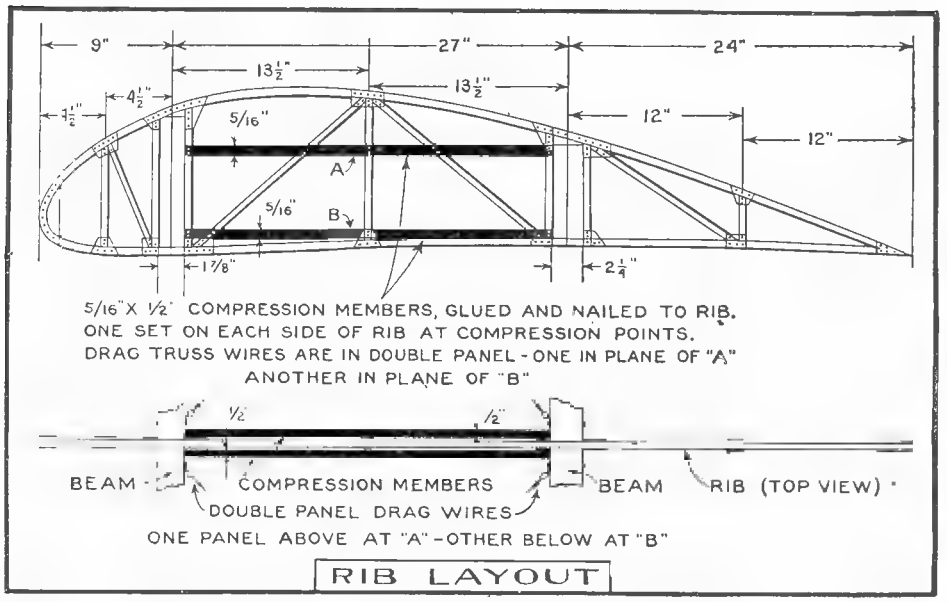
I built a frame against the building to lay the wing on perfectly flat about six feet above the ground, with supports spaced to allow the fuselage to run under, and jacked same up on blocks until a space of eighteen inches was present from the top of the upper longeron to the lower surface of wing. Both were leveled accurately sidewise and fore and aft, with the fuselage square with the wing. Then I cut and fitted my complete set of struts, center and outer hold-downs were attached, the cross cable drag braces were installed, the wing supports were removed and job was rigid and true.

The center section drag tube from the top of the motor to the first "V" strut at the point of the wing connection fuselage is a ¾ in. x .049 in. steel tube.

In rigging up the controls a little observation of other types would be of assistance.

The cables should have no slack, yet should not be tight, lest any strain should be put on control surfaces or manuals.

A good rule is this—have the cables just tight enough so that when the stick is moved ½ inch the control starts to move.



Detail drawing showing how to reinforce wing ribs with compression members glued and nailed as indicated.

There should be no binding of any control hinge or cable and this is important. All controls must work free and positive. The elevator control wires must be crossed, so that you must kick your right foot to turn right. Push the stick ahead to nose down—draw the stick back to climb. Press the stick to one side and that wing droops.

Any power plant may be used in this plane from 35 h.p. to 60 h.p. and can be easily installed by simply changing the type of motor mount.

The motor should be mounted last to secure the last final balance of the complete ship.

Regarding flight; self instruction is both costly and dangerous. While men have taught themselves to fly, a hundred dollars spent for training is a good investment, considering the chances of wrecking the little plane in self-instruction.

Taxying is very beneficial, as it gives one a fair sense of control. Get used to the motor blast, and become familiar with the cockpit.

For those who take regular instruction these remarks will not be necessary.

In cranking the engine be careful—a blow from the propeller will put a large dent in the hardest physique.

Always treat an airplane propeller with the greatest respect, even though you know the switch is off. This is no toy or joke and I cannot lay too much emphasis on the fact that you are now in a man's game, full of danger to the careless, but just as safe as the modern automobile to the thoughtful and careful.

Here's how you operate—one person in the cockpit, one at the propeller. The one at the propeller orders—"Switch off, throttle nearly closed, and choke." One in the cockpit repeats and does as ordered. One at the propeller spins the motor about four or five times to flood it, doing so carefully, he then steps back clear and orders "contact." From cockpit the word is repeated and the switch is thrown on. The man at the propeller grasps it, having had it set just ahead of compression and pulls it sharply through, downward, and instantly steps back clear. If the engine fails to start, he orders the switch off, before setting the engine to compression again. The pilot by repeating the orders, eliminates the chances of misunderstood signals, which have resulted in many serious accidents.

Also, always have blocks or chocks before the wheels to hold the plane from running forward while cranking or warming up. The beginner should tie the rear end to a pinch bar driven into the ground.

After the motor is thoroughly warmed up, throttle down and remove the chocks.

A slight burst of revs. should cause the plane to taxi slowly. Sharp blasts of gun effect best rudder control. Shoving throttle forward should open the carburetor "giving the gun."

Taxi carefully, getting the flipper and rudder control feel. The first taxis will undoubtedly be very erratic, but practice should soon permit you to taxi at full speed with the tail up, clear across the field in a straight line. Never drop the tail with gun on, at full speed, or you are "off."

A field at least 80 rods long is advisable with little or no obstructions such as high tension wires or trees nearby.

Once you can taxi in a straight line at full speed, short hops may be tried at the center of field, not getting more than a foot or so above the ground to get aileron feel. Always taxi fast into wind, slow, with the wind and never with a side wind, if it can be avoided.

You will find all this out soon enough but a little tip here may save you from an accident and from much expense and delay.

Now if you MUST learn to fly alone—Well—

After you have learned to taxi in a straight line—tail up; full speed—get way back to far end of field, head ship into the wind, be sure everything is all right—"take a long breath" press the stick forward to get the tail up and give her the gun—wide open.

As you pick up speed and the tail rises, ease the stick back until at full speed, the plane taxies straight with tail and wing at 0° angle and the stick in neutral.

When this speed has been attained start easing back on the stick gently lowering the tail to about 5 degrees of wing angle, when the ship should leave the ground smoothly, and start an even ascent.

DON'T pull the stick sharply back and then climb too steep or fast. This will be a tragedy; as the best angle of climb will be somewhere between 3 and 8 degrees, depending on the power plant.

Be content to hold a hundred feet or so of altitude over favorable territory until you are sure of yourself.

Make your first turn very shallow. Move the rudder slightly and lean the stick just a little to bank, as you turn. Make your first turn cover two or three miles or so, and then, as you get familiar, increase the range.

In vertical banks—remember the reversal of control action.

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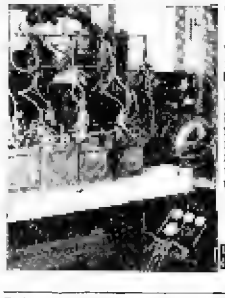

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Coming into land—come into the wind straight at the field. Here only practice will help you. Gradually nose down, throttling as you approach the field, keeping full flying speed until leveling out, just about a foot above the ground, then cut throttle, ease tail down as the plane settles, and just as it lets go put the tail down and hold her there. Don't stop flying until the plane comes to a dead stop or you may do a beautiful ground loop before you know what it is all about.

Simple isn't it, but oh boy, what a thrill and how you do have to fly that bus!

The first hour or so the nose of the ship wanders all over the horizon and you may even decide that you will never be able to master that cloud riding devil, but each flight brings more comfort and skill, until you will soon be totally unaware that the ship has a nose at all, and you will be making dead stick landings and everything.

Don't attempt flights in gusty hot weather until you are good. Early in the morning and late in the evening is the ideal time to fly. At noon the ascending air currents cause bad bumps which are very disconcerting to the beginner.

The plane will sometimes drop right out from under you, and then it is a good plan to have a safety belt on. Again you will get heavy in the seat as she rises up on a bump, but don't get rattled; sit tight and ride her out. You will find that the plane always catches itself when it lets go, if you have not stalled her.

Further Construction Details

Drawing 6 shows another popular type of hinge for light planes made up of cotter keys.

Starting on lower surface at front beam position, forward, over the leading edge, and back to front beam on upper surface put on a covering of .010-inch sheet aluminum with ⅜" x 20 gauge nails. This aluminum covering runs the full span of the wing and secures an even surface at the leading edge.

The bolt "A" for aileron pulleys is 5/16" steel and extends ¾-inch beyond upper and lower surfaces, permitting pulley attachment.

Wing tip is covered with aluminum also and this is a job that requires patience to get a uniform job. Hold-down fittings should be installed as per drawing.

Ailerons should be built up and tried for fit before covering; in fact, all surfaces should be tried in this manner.

Wing should now be ready for finishing, and is covered with Flightex, a high-grade cotton cloth developed for aviation use.

In covering surfaces, stretch cloth tight enough to remove all wrinkles and be uniformly taut.

Small upholstery tacks are used in tacking cloth to ribs. If cloth is secured 36 inches wide, it will just cover surface between four ribs on wing with least waste.

There are many methods of covering and the builder can choose his own.

Some stitch the cloth into one large cover and put all on at once, pillow-slip style. This is a good method also.

Cloth is sewed by hand to trailing edge. At intervals of six inches across the chord of each rib, cloth should be sewn clear through the wing, a complete loop of thread around the rib; drawing the cloth surfaces close to the ribs.

A 12-inch needle and special cord for this may be purchased from any reliable supply house.

After the wing is covered, it may be hung up as in photograph, from hold-down fittings.

Now dope cloth in four-inch wide strips at each rib and while doping apply two-inch pinked tape on both upper and lower surfaces, at tips and at trailing edge; in fact, at any point where cloth comes in contact with the framing.

Next, wing may be given three light coats (brush) of clear dope, then, having decided on color scheme, apply three more coats dope which has been pigmented with the desired color.

For a permanent job give two coats of clear spar varnish over all.

I have found that pigmenting the dope this way gives a smooth, even finish, while pigmented varnish is dull in finish and seems to be less taut when finished.

Wing is now done and should have a smooth, shiny surface—no wrinkles in fabric and should have no twists or "waves" in the wing proper.

Perhaps a word or two on the construction of the main wing spars or beams would not be amiss, although drawings are very clear on this detail. The main beam members are cut to size and spliced to form continuous pieces for the full span. A good unwrapped splice may be made by cutting wood at such a level that the splice will run a length of ten inches, treated with the best glue attainable (I used Heath's waterproof propeller glue. This is rather expensive but the work justifies the best) and allowed it to set under moderate pressure for at least 24 hours. This splice is a simple slant cut, there being a distance of ten inches from where the cut starts on one side of spar and where it ends, on the opposite side.

In laying the two main members out in building up the beam, care should be used in staggering splices, so that no two splices should be at the same spar position.

These main members are now laid out on a smooth floor at the proper parallel spacing, the wooden filler blocks glued and nailed in. Then the plywood having been cut to desired strips and spliced, is glued and nailed to the main members. The completed spar being a hollow box type, is very rigid, having stood repeated dive, zoom, and other excessive strains during tests.

The tail planes may next be built up. Drawings show sizes, materials and details.

Tail planes may be best assembled on a flat bench or table at least eight feet in length and two feet in width, so that completed units will be straight and true.

Ribs being simply 3/10" x ⅝" strips nailed and glued to both sides of the one-inch main beams, outline being ⅜" x 20-gauge steel tube.

These planes may be built up of steel tube welded also, which requires a jig, a good welder's assistance, and is much more expensive.

Here let me say that the amateur should not try to do his own welding in anything pertaining to airplane structure, as the ordinary farmer's machinery cast iron welder fails utterly when he tries to make a steel tube joint that is as strong as the tube itself. I've seen this kind of work and its disastrous results.

The tail planes are covered and doped in the same manner as the wing. All hinges should be attached before covering and parts assembled by inserting the connecting pin. The cotter pin hinge is the simplest and most popular for light plane construction.

In assembling the fuselage, it is a very good plan to draw the full sized outline on wooden floor or building side, and nail blocks for a simple jig.

This jig should be of side plan; then both sides being made may be easily assembled into the whole very nicely. It may be necessary to steam the fuselage longerons at front portion to facilitate bending, but was not necessary in our job.

It is necessary to steam the rib outline strips at leading edge portion, to prevent cracking when sharply bent to form the required upper curve.

All fittings should be installed before covering fuselage, also seat and controls.

In fact, the best plan is to build up the whole ship and assemble as built, uncovered; in this way fits are assured without delay of uncovering to correct faults.

Is a College Education Worth While?

(*Continued from page 275*)

Education Teaches Tolerance

HAVING mentioned the sustaining help of college friends, I believe I should be sinfully remiss should I fail to mention another valuable feature. I know that my recovery from my long illness depended considerably upon the constant care of my wife and upon the wise advice and calm assurance of our family doctor. I voted for Hoover. My doctor voted for Smith. My wife sat up until midnight "listening in" to the Democratic Convention. I have the greatest respect for the doctor, and if my wife votes the straight Democratic ticket that's O. K. with me. I know quite well that my college education increased my tolerance of human nature. I believe a college training teaches tolerance in politics, in society and in religion.

Faculties Versus Students

IF a college education fails to be worth while to the normal boy or girl, I think it must be due to the inefficiency of one of two parties: the faculty or the student; it is seldom if ever due to the inefficiency of both.

It has been my observation for a number of years, and my experience for a lesser period, that college faculties as a whole are most dependable organizations.

At present I am not connected with any college faculty (which is in their favor) so you will understand I am not writing for policy or subsidy.

One valuable asset of my college courses has been the sustaining example of the fine standard of manhood possessed by my old Professors.

The student who is respectful toward his instructors has the elements of culture in his make-up.

College Education Diluted with School

I DO not believe a college education can ever be as worth while for any boy who indulges an appetite for intoxicating drinks as for those who do not.

No person can simultaneously serve well any two masters one of which is alcohol.

Culture and alcohol have never yet found a desirable mixture.

That boy who does not possess the stamina to keep intoxicants from his physical system will never become a man of culture and social respect; in college or out.

It is my advice to any boy entering upon a college career to make a sacred contract with himself not to taste a single drop of alcoholic drink while he is attending college.

Should Amateurs Build Gliders from Blueprints?

By Prof. Alexander Klemin

(*Continued from page 233*)

the danger of a crack, which may remain unnoticed. The answer to this point is: why should not the expert designer of the blue-prints take some care to avoid such difficulties in the construction of the fittings? Again there is the question of the inspection of wood. It is a comparatively simple matter to inspect wood, at least to the extent required in glider work. It should not be impossible in two or three hundred words to give simple and adequate instructions for checking the grain, avoiding knot holes, etc.

Those Who Build Will Make Better Operators

IT is quite true that a group of young men who start out with the greatest enthusiasm may fall off by the wayside, but, if they do survive the difficulties, they will have learned a great deal more than the group which merely buys its glider ready made. They will have become familiar with materials and processes and this will be a splendid introduction to all manner of engineering and industrial occupations. They will understand their craft much better than the boys who bought theirs ready made, and what is more they will be much better operators. If anything goes wrong or breaks, they will know much better how to make repairs, and once their glider is built they are much more likely to persist in the sport than are the men who bought their machines, and are also much more likely to introduce improvements in the glider art.

Glider Construction Particularly Easy for Pupils in Manual Training and Engineering Schools

GLIDER construction should be particularly easy for pupils in manual training and engineering schools, where shop processes are systematically taught. The great drawback of all shop instruction in schools is that the objects built are for the most part useless or at least not likely to be used. How much more enthusiasm would a shop-class show if they could build a glider which they would subsequently fly themselves? It should be noted also that in every large city, and in many small cities, the number of airplane mechanics or engineers ready and able to give advice is now quite large.

Amateur Construction Possible with Certain Precautions from Blue Prints

IN conclusion we may say that amateur glider construction is possible and desirable provided certain rules are observed:

The blue-prints should be above reproach and should have been drawn up by the experts, not for the edification of other experts, but with a view to helping the amateur.

With the blue-prints there should be available simple instructions as to methods and materials.

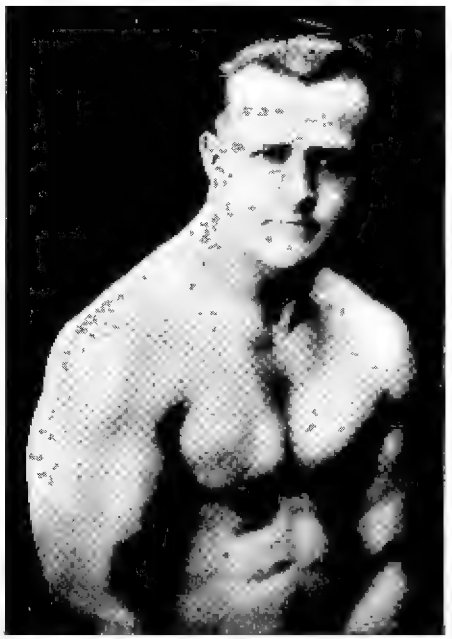
Help should always be secured from some competent person for the inspection of the materials and of the construction as it goes along.

Before starting out the amateur builders should familiarize themselves with the difficulties of their task, find out what money, materials, tools they will need, and what space and other facilities should be available.

Before starting out on the final flight they should certainly obtain the very best expert inspection they can.

There is no reason, in the writer's personal opinion, why the National Glider Association, which will act in an advisory capacity as regards glider operation, should not act in a similar capacity as regards glider construction.

Provided, all these precautions are observed, we do not see why amateur glider building should be any harder than amateur glider operation and why it should not be just as valuable an educational agency.



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The Man I Pity Most

POOR OLD JONES. No one had any use for him. No one respected him. Across his face I read one harsh word—FAILURE. He just lived on. A poor, worn-out imitation of a man, doing his sorry best to get on in the world. If he had realized just one thing, he could have made good. He might have been a brilliant success.

There are thousands of men like Jones. They, too, could be happy, successful, respected and loved. But they can't seem to realize the one big fact—that practically everything worth while living for depends upon STRENGTH—upon live, red-blooded he-man muscle.

Everything you do depends upon strength. No matter what your occupation you need the health, vitality and clear thinking only big, strong, virile muscles can give you. When you are ill, the strength in those big muscles pulls you through. At the office, in the farm fields, or on the tennis courts, you'll find your success generally depends upon your muscular development.

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But I'm not through with you. I want ninety days in all to do the job right, and then all I ask is that you look yourself over.

What a marvelous change! Those great squared shoulders! That pair of huge, lithe arms! Those firm, shapely legs! You'll be just as fit inside as you are out, too, because I work on your heart, your liver—all of your inner organs, strengthening and exercising them. Yes, indeed, life can give you a greater thrill than you ever dreamed. But, remember, the only sure road to health, strength and happiness **always demands action. Start now!**

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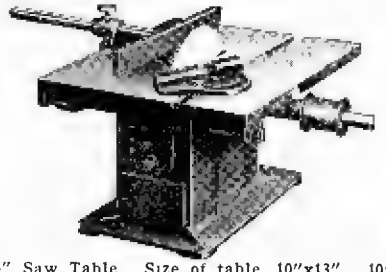

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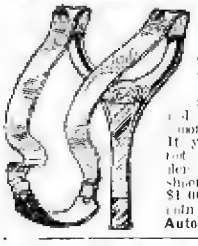

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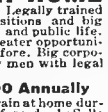

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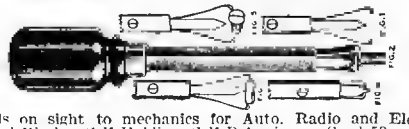

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Airplane Radio Reports Outboard Boat Races

By William F. Crosby

(*Continued from page 215*)

come down on the line—faster and faster—until just at the last second they all open up wide and as the gun sounds, they tear across in a welter of foam and spray. At the Albany race, about thirty or forty boats crossed the line with the gun, the others starting anytime within the next half hour. After that time no starter would be recognized.

Train Carries Officials

ONCE under way, the officials at Albany boarded the New York Central's Southwestern Limited and then began a long chase down the length of the river. Dunnell's boat was not overtaken by this fast train for nearly two hours and when the train stopped to change locomotives at Harmon, N. Y., Dunnell passed it and was well on down the river again before the train caught up. The officials had to leave the train at the 125th Street station and, with a special motorcycle escort, they raced across town to the Colonial Yacht Club to get there in time for the finish. Needless to say, not all of them arrived in time.

Second to Dunnell came Julius Herbst of Wilmington, North Carolina, in a big, husky craft of his own making. He, too, had a Johnson motor like the winner's. Herbst was nearly ten minutes behind Dunnell's boat. Since the first boat in had won the Haynes-Griffin grand prize of $500.00, Herbst was eligible for the Class D outboard trophy.

Only ten seconds behind Herbst, came R. Pregenzer of Antioch, Illinois, with his Century Cyclone, equipped with a new Elto Quad. This engine made Pregenzer the winner of the Class D prize. Whim, driven by B. Flower of Bayville, Long Island, came in fourth and the Evinrude motor used gave him the Class C prize. Just four minutes later E. H. Patterson, driving Miss Shirt, of Troy of course, came in. Patterson with his Evinrude motor won the novice prize offered by one of the boating publications and also a cash prize for finishing first in the particular type of hull that he used.

The first Class B boat and engine to finish was Miss Berkshire driven by A. Eckert, Jr., and powered with a smaller Johnson motor. The hull was made by a firm in St. Louis.

Most of the finishing boats came in rather close together and the seventh and eighth boats finished exactly even, a third boat just nosing them out as they crossed the finish line.

New Transatlantic Flight

By Augustus Post

(*Continued from page 203*)

and I have come to these conclusions: first, that land planes have no business attempting such flights. The hazard is altogether too great. Secondly, that the dirigible, while it has a much greater margin of safety than the land plane, is still subject to risks that would not be enticing to the average cool-headed business man. It can only land at an aviation depot, where a trained crew is required to handle it. If it were forced down in the ocean, I am afraid it would hardly last as long as the land plane under similar conditions.

"The only sane and logical means of transportation across the ocean, therefore, is by means of a boat—a boat with wings. And that is exactly what I have been building for the past six years. The famous "Luft Hansa" in Germany have been using my all-metal flying boats for some time, as have the governments of England, Italy, Japan and Turkey.

"For this transatlantic service I have developed a special flying boat—the "Rostra"—it is really a small cruiser with a bow 20 feet high and a body some 100 feet in length. It carries a 60 pound anchor and can be rigged with jury masts and sails and manipulated as a sailing vessel. The single, all-metal wing which carries this cruiser into the air—its absolute ceiling is around 10,000 feet—measures 90 feet from tip to tip. Forty men can stand in a row along its top. It is motored with two powerful Jupiter engines which are built on nacelles or superstructure above the center of the wing. They develop a combined driving effect of over 2000 horsepower and produce a maximum flying speed of approximately 148 miles per hour. Of course, on ocean flights we will use the cruising speed, which is 118 miles per hour. The ship can fly on one motor also.

American Girl Aboard

"IN the early part of June the Rostra will take the air from Travemunde, a small summer resort on the Baltic, bound for New York harbor. She will have a crew of five, including a very charming American girl—Miss Mildred Johnson of Philadelphia—who has been of invaluable assistance to me in preparing for the flight. This lady has arranged for the cargo to be carried on the trip—2000 pounds in all—and is in fact the first aerial express agent of history. Being a former newspaper writer I expect she will also keep a graphic log of the flight.

"The first stop of the flight will be at Lisbon, Portugal, where the 2000 pounds of cargo—consisting of various sorts of merchandise—will be shipped aboard, much of it consigned by the American Express Company of Europe to the American Railway Express in America. From Lisbon the Rostra will head to Cape Verde, on the north coast of Africa, thence across the southern route of the Atlantic to the island of Fernando Noronha, which lies just northeast of the coast of South America. This small island in the South Atlantic, which is already being used by the Pan-American Airways as a repair and refueling station in their flights between North and South America, will probably become the halfway station of the projected "Luft Hansa" flights between Europe and South America, which start this spring.

"We will spend about eight hours at Fernando Noronha, for an examination of the engines and plane and for refueling and will then proceed on our way to New York harbor and the Statue of Liberty. The whole trip should take us about three days, or half the time of the best steamer crossing. For this first trip the cargo charges have been set at three dollars an ounce, but this, of course, will be lowered as soon as a regular service gets under way.

"You will pardon me if I say that I think the coming flight of the "Rostra" marks the beginning of a new era, in the commercial relationship of Europe and America, and opens a new field of enterprise to a world which is rapidly finding itself on wings."

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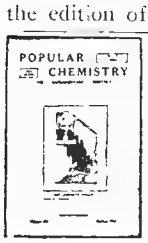
Medical authorities agree that 65% of all men past middle age (many much younger) are afflicted with a disorder of the prostate gland. Aches in feet, legs and back, frequent nightly risings, sciatic pains, are some of the signs—and now, a well known American Scientist has written a remarkably interesting Free Book that tells of other symptoms and just what they mean. No longer should a man approaching or past the prime of life be content to regard these pains and conditions as inevitable signs of approaching age. Already more than 50,000 men have used this amazing method described in this book to restore their youthful health and vigor—and to restore the prostate gland to its proper functioning. Send immediately for this book. If you will mail your request to the Electro Thermal Company, 4519 Morris Ave., Steubenville, Ohio—the concern that is distributing this book for the author—it will be sent to you absolutely free, without obligation. Simply send name and address. But don't delay, for the edition of this book is limited.—*Adv.*



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What Our Readers Think

(*Continued from page* 245)

mon to other musicians. A given time would then be very likely to set up transference from the mind of the mental singer to the equally musical subject, their brains being "en rapport" with and well acquainted with the pitch of a given tune, from years of practice and exercise. If then, instead of trying first "wireless" transference, use were made of two electrodes, touching an atomically correct spot, one at the scalp and another applied to both hands, and a tune known to both (but the subject not knowing what tune was to be used) be conducted to the electrodes by wire from some room quite out of hearing of the subject, there would be a better chance of it being detected by the subject. The tune could be produced by a gramophone in front of a microphone, thence to a modulator valve acting on any suitable carrier wave injected into the mechanical circuit of which the subject is part. No sound would, of course, be heard in any of the apparatus outside the music room.

J. A. Paterson,
Christchurch, New Zealand.

(It is scarcely likely that experiments along this line would assist in thought transference. Of course, the two individuals concerned would probably have their minds keyed to the musical thought to a greater extent than those making the test with cards or other materials. We are nevertheless glad to pass the idea along for what it may be worth.—Editor.)

Recording Colors in Black and White

(*Continued from page* 216)

Technology, records of colors can be made and can be preserved for all posterity. Photographs of the instrument accompany this article.

In order to explain how it works, a diagram will be found which will aid in disclosing the method of operation. As will be observed, the light from an incandescent lamp passes through lenses and falls perpendicularly on both the specimen and the standard, which is magnesium carbonate. Magnesium carbonate is the whitest substance known. Light is reflected from the standard and from the sample, and enters a slit of an ordinary spectrograph system. Immediately in front of the slit, we find a rotating glass disc, having alternate silvered and transparent segments. The disc is so located that light from the standard enters the slit when a transparent segment of the flicker disc is in the beam. This light then passes through the prism which breaks it up, and thence through a second slit to fall on a photo-electric cell. Thus the photo-electric cell receives a monochromatic or a single wavelength light of pulsating intensity because first, the light comes from the standard, and after that light is reflected from the sample.

This pulsating light intensity, when acting on the photo-electric cell, changes to a pulsating current. The current is amplified and is used to run a small motor. The motor actuates a shutter in the beam between the light source and the standard, and automatically finds a position where the pulsations of light cease. This position is independent of any characteristics of the photo-electric cell. A pen is attached to the mechanism controlling the shutter to record the reflecting power of the specimen on the rotating drum. A second motor rotates the drum and at the same time drives the slit across the spectrum, thus giving a complete color analysis in less than a minute.

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City Post Office Clerks
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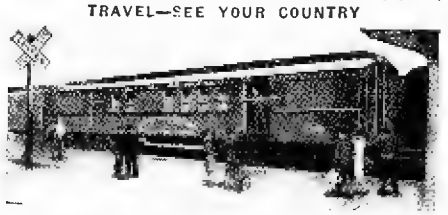

Railway Postal Clerks, like all Government employees, have a yearly vacation of 15 working days (about 18 days). On runs, they usually work 3 days and have 3 days off duty or in the same proportion. During this off duty and vacation their pay continues just as though they were working. They travel on a pass when on business and see the country. When they grow old, they are retired with a pension.

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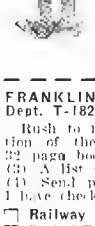

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High Lights in Radio History

By Paul L. Welker

(*Continued from page* 249)

On November 16, 1904, Dr. J. Ambrose Fleming took out his original patent No. 24850 for thermionic valve.

The Audion

DR. LEE DE FOREST, rightfully called the father of radio, was granted a patent in 1906, for a vacuum tube rectifier known as the audion. In the years from 1908 to 1911 the United States Navy built the first high-powered radio station at Arlington, Virginia.

The Years 1912 and 1913

DR. FREDERICK A. KOLSTER of the United States Bureau of Standards developed and invented the Kolster decremeter. During this year the first practical experiments with wireless apparatus on trains were made by the Delaware and Lackawanna and Western Railroad.

Regenerative Circuit

E. H. ARMSTRONG was granted a patent on Oct. 6, 1914, covering the regenerative circuit. On December 17th of 1915 the first radiophone message was transmitted across the Atlantic. Communication between the United States and Japan was made, the messages being relayed through Honolulu.

Super -Regenerative Circuit

ON June 7, 1922, Major E. H. Armstrong was granted a patent for the super-regenerative circuit.

Short Waves and High Power

PROGRESS was made during the year 1925 in the short wave communication field and foreign stations were worked at wavelengths varying from 22 to 103 meters.

Neutrodyne

ON March 2, of the year 1923, Prof. Louis A. Hazeltine, of the Stevens Institute of Technology, presented a paper before the Radio Club of America, dealing with the neutralization of capacity coupling in tuned radio frequency amplifiers, and was granted a patent for a non-radiating neutrodyne receiver. Broadcasting programs from airplanes was also accomplished and the General Elec. Co., Radio Corp. of America and Westinghouse Elec. & Mfg. Co., conducted experiments in high powered transmission, using as much as 50 kilowatts. Quartz crystals were also used to maintain a constant frequency, and in the year 1926 the use of quartz plates for maintaining a constant frequency was inaugurated extensively in many radio transmitters. During 1926 receiving sets were perfected and the single dial radio receiver came into great use.

Television

TRANS-ATLANTIC radiophone service was opened to the public on January 7, 1927, and on April 7 in the same year a successful public demonstration of television was made in New York. Radio was first used by the airplane, America, in crossing the Atlantic Ocean from the United States to France. Receiving tubes, with filaments heated from an alternating current source, come into popular usage, and chain broadcasting programs were increased.

Light socket operated receivers and dynamic speakers came into greater use during the year 1928, and The General Electric Co. developed a vacuum tube 5 inches in diameter and 2 feet long. This was capable of operating as a self-excited oscillator on a wavelength of 6 meters and radiated from 10 to 15 k. w., of high frequency power.

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In RADIO NEWS for July

"THE VELVETONE-29." A new 5-tube A. C. screen grid tuner kit designed for A. C. operation in conjunction with a power amplifier. This kit, described in detail by James Millen and Glenn Browning, makes use of the new tubes in a circuit providing exceptional quality and high gain, with single control tuning.

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MAKING THE MOST OF RADIO AIDS TO AERIAL NAVIGATION. Mr. Zeh Bouck tells here the steps that are being taken by American aviation interests to make air transport safe.

ON THE SHORT WAVES. Thomas Marshall describes the results of a nine-months' test on extreme short wave reception, aboard the U. S. S. California, over distances up to 2,000 miles. He gives, also, complete details of the highly interesting push-pull tuner circuit used in these tests.

LIEUT. WENSTROM, U. S. Military Academy, West Point, N. Y., presents the details of a practical, portable short wave transmitter and of an equally practical portable receiver, covering a wide range of frequency channels.

A LOW-COST, TUBE AND SET TESTER. M. K. Barber describes, and gives full constructional details of, a test set which will permit making all necessary tests in servicing receiving sets. Best of all, it can be constructed at a total cost of about $16.

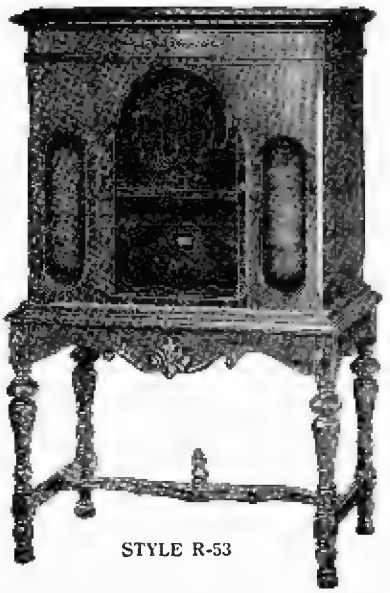
On April 15th, this publication was acquired by the Mackinnon-Fly Publications, Inc. This company is also the publisher of PLAIN TALK, SCREEN BOOK MAGAZINE, WILD WEST STORIES and COMPLETE NOVEL MAGAZINE, COMPLETE DETECTIVE NOVEL MAGAZINE, RADIO NEWS, AMAZING STORIES, YOUR BODY QUARTERLY, AMAZING STORIES QUARTERLY, and AERO MECHANICS.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, of Science and Invention, published monthly at New York, N. Y., for April 1, 1929.

State of NEW YORK }
County of NEW YORK } ss.

Before me, a notary public in and for the State and county aforesaid, personally appeared Gustav Gardner, who, having been duly sworn according to law, deposes and says that he is an Assistant Vice-President of Irving Trust Company, owner, as Trustee in Bankruptcy of the Science and Invention and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit: 1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Irving Trust Company, as Trustee in Bankruptcy of Experimenter Publishing Company, 233 Broadway, N. Y. City; Editor, Arthur J. Lynch, 230 Fifth Ave., N. Y. City; Managing Editor, None; Business Managers, B. A. Mackinnon, 230 Fifth Ave., N. Y. City. 2. That the owner is: The Irving Trust Company, of 233 Broadway, New York City, as Trustee in Bankruptcy of said Experimenter Publishing Company, Inc., said Irving Trust Company having been duly appointed Receiver in Bankruptcy on February 20, 1929, and Trustee on March 28, 1929. 3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None. 4. That the two paragraphs, next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him. 5. That the average number of copies of each issue of this publication sold or distributed through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is (This information is required from daily publications only). Signed, Irving Trust Company, by G. Gardner, Assistant Vice-President. Sworn to and subscribed before me this 2nd day of April, 1929. (Seal.) Hiram S. Gans. (My commission expires March 30, 1930.)

PHONO Radio Consoles



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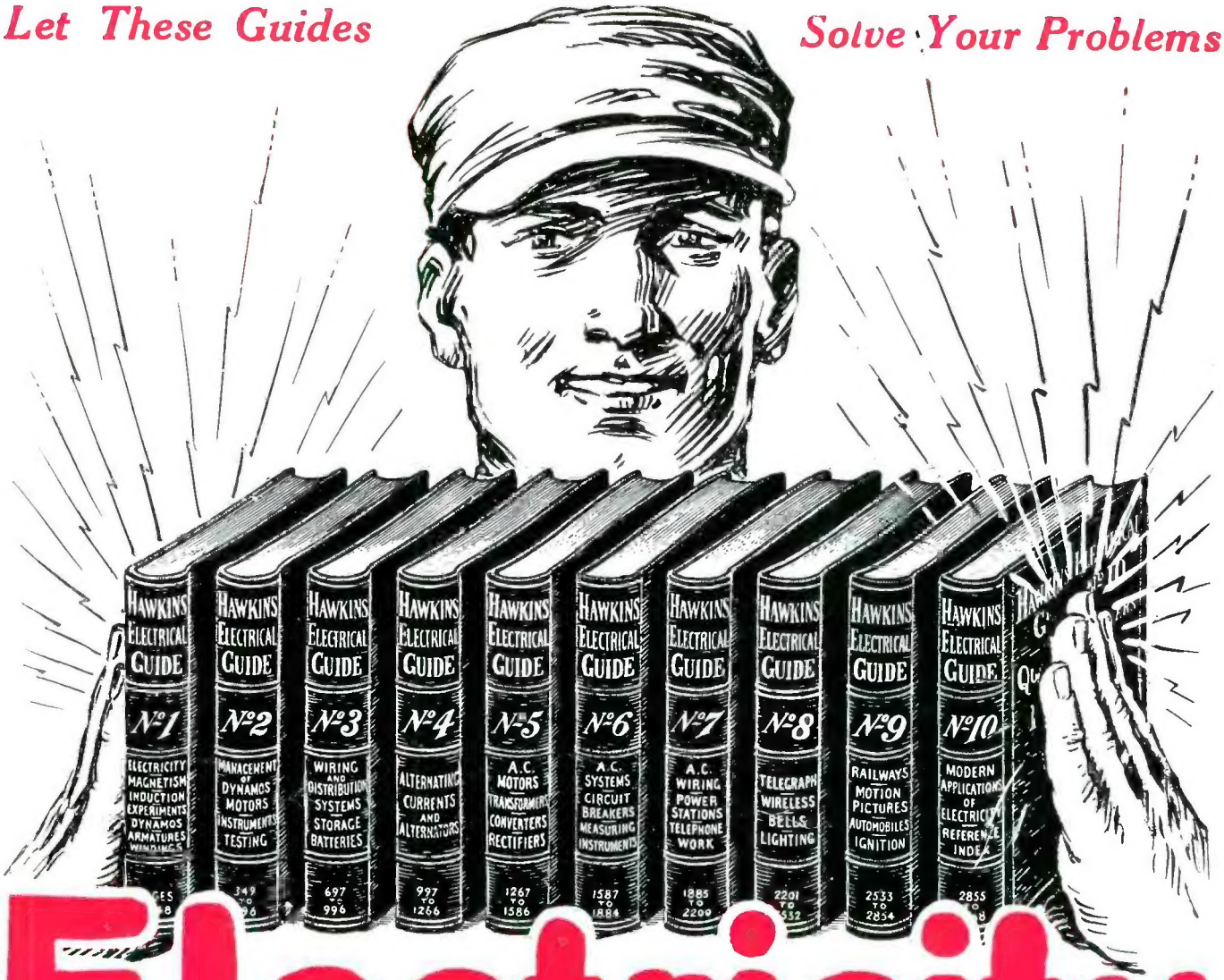

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